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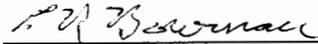
SPECIFICATIONS  
FOR  
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IN THE TEST COMPLEX  
PHASE II

12B00-GS58

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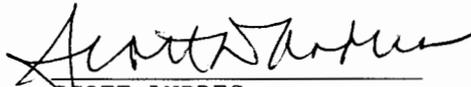
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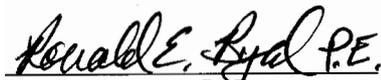
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SPECIFICATIONS  
FOR  
REPAIRS TO 13.8KV UNIT SUBSTATIONS  
IN THE TEST COMPLEX  
PHASE II

12B00-GS58

MAY 2006

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
JOHN C. STENNIS SPACE CENTER  
SSC, MISSISSIPPI 39529

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## SECTION 01010

## SUMMARY OF WORK

## PART 1 GENERAL

## 1.1 SUMMARY

This project provides for the installation of new 480V switchgear components and the removal of existing electrical equipment.

The work to be performed under this project consists of providing the labor, equipment, and materials to:

- Remove existing 480V switchgear
- Procure/install new 480V switchgear
- Provide System Coordination and Testing Services for all circuit interrupting devices

## 1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures:"

## SD-01 Preconstruction Submittals

Utility outages and connection requests

Borrow, Excavation, Welding, and Burning Permits

## 1.3 CONTRACT DRAWINGS

The following drawings accompany this specification and are a part thereof.

Drawing No. 06B228-01  
Docs V1, E1 - E8

Dimensions on drawings shall be checked for accuracy by the Contractor. The Contractor shall determine exact dimensions for proper fit. Drawings shall not be construed as being detailed working drawings.

Five sets of full scale contract drawings, maps, and specifications will be furnished to the Contractor without charge. Reference publications will not be furnished.

The Contractor shall immediately check furnished drawings and notify the Government of any discrepancies.

## 1.3.1 Reference Drawings

Detail reference drawings and schematics of existing installations will be provided by MSS Central Engineering Files (CEF) upon request by the Contractor. The Contractor must verify actual field conditions.

## 1.4 WORK RESTRICTIONS

The area that this project involves is currently being used in support of

active test programs at Stennis Space Center. Periodically, access to the construction area will be restricted in preparation of these test activities. The Government will provide 24 hours written notice when access to the construction site will be restricted during normal working hours. Written notice shall be provided by email or fax to the Contractor's primary office or temporary on-site office. The Contractor will not be compensated for equipment, labor and tools standby time during the restricted period. For any restriction to the construction site during normal working hours with less than 24 hours written notice, the Contractor will be compensated for equipment, labor and tools standby time during the restricted period. The Contractor shall secure all tools, tool boxes, equipment, machinery and appliances and protect them from heat, water and/or vibration damage at the end of each day.

All Contractors performing work at the A1 Test Stand (B4120), A2 Test Stand (B4122) or A-Test Control Center (B4110) must sign in with Test Stand Engineering, Level 2 A1 Test Stand or A2 Test Stand respectively prior to performing work, to coordinate the work activity with Test Stand Engineering and ensure the safety and readiness of the facility.

All Contractors performing work at the B1 Test Stand (B4220) or B-Test Control Center (B4210) must sign in with Test Stand Engineering, Level 4 B1 Test Stand prior to performing work, to coordinate the work activity with Test Stand Engineering and ensure the safety and readiness of the facility.

Work performed on Fridays should be coordinated with Test Stand Engineering no later than Thursday the day before. For emergency type situations, all Friday work for B1 or the B-Test Control Center should be coordinated with A2 Test Stand (4122) Engineering.

#### 1.5 NORMAL DUTY HOURS

Normal duty hours for work shall be from 7:00 a.m. to 3:30 p.m., Monday through Friday. Requests for additional work shall require written approval from the Contracting Officer 7 days in advance of the proposed work period.

#### 1.6 OCCUPANCY OF PREMISES

The building(s) will be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area.

### PART 2 PRODUCTS (Not Applicable)

### PART 3 EXECUTION

#### 3.1 OCCUPANCY OF PREMISES

Before work is started, the Contractor shall arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

#### 3.2 TEMPORARY STRUCTURES

Contractor-owned trailers or storage structures shall be prohibited on Government property without prior approval from the Contracting Officer. The Contracting Officer shall approve the location, type, and quantity of Contractor-owned trailers or storage structures. Trailers and storage structures shall be adequate for the required usage, shall not create

unsafe conditions, and shall not violate applicable codes and standards. A 24-inch by 24-inch sign must be affixed to each trailer or storage structure containing the following information:

Company Name  
Mailing Address  
Company Phone Number  
Emergency Contact Phone Number

NASA, at their discretion, shall inspect these Contractor-owned trailers or storage structures for compliance with OSHA, NEC, DOT, Life Safety Code and Uniform building Codes.

### 3.3 ON-SITE PERMITS

#### 3.3.1 Utility Outages and Connection Requests

Work shall be scheduled to hold outages to a minimum.

Utility outages and connections required during the prosecution of work that affect existing systems shall be arranged for at the convenience of the Government and shall be scheduled outside the regular working hours or on weekends.

The Contractor shall not be entitled to additional payment for utility outages and connections required to be performed outside the regular work hours.

Requests for utility outages and connections shall be made in writing to the Contracting Officer at least 7 working days in advance of the time required. Each request shall state the system involved, area involved, approximate duration of outage, and the nature of work involved.

#### 3.3.2 Borrow, Excavation, Welding, and Burning Permits

<u>ACTIVITY</u>	<u>SUBMISSION DATE</u>	<u>SUBMISSION FORM</u>
Burning	14 days prior to work	Request by letter
Excavation	7 days prior to work	Request by letter
Welding and Hot Work	7 days prior to work	Request by letter

Permits shall be posted at a conspicuous location in the construction area.

Permits are the property of the Government and shall be returned to the Contracting Officer upon completion of permitted work.

Burning of trash or rubbish is not permitted at Stennis Space Center.

### 3.4 MATERIAL AND EQUIPMENT STORAGE

Storage of material and equipment shall be prohibited in all active mechanical and electrical equipment rooms. Temporary staging of material and equipment, in a mechanical or equipment room that is under construction, for the intent of accomplishing daily tasks in that room shall be allowed provided that the material and equipment does not create unsafe conditions and does not violate applicable codes and standards. Unused flammables and combustibles shall be removed from active mechanical and electrical equipment rooms prior to the end of each workday. Longer term storage and staging shall be provided by the Contractor, outside of Government building(s), or in an approved unoccupied room which has been

approved by the Contracting Officer's Technical Representative.

Contractors will be provided designated on-site locations, in reasonable proximity of the construction site, for which they will be allowed reasonable space for storage of equipment and materials. The Contractor shall supply trailers, canisters, tarps, barricades, and/or other temporary structures necessary to protect and secure stored materials. Proper storage, shelter and protection of equipment and material shall be the responsibility of the Contractor. Storage in open yard or lawn areas shall be barricaded to prevent unauthorized or inadvertent entry, and shall have clearly designated signage.

Storage area signage, whether inside or outside of Government buildings, shall clearly identify access restrictions, required PPE and other site specific hazards. The Contractor's signage and barricades shall be sufficient to prevent inadvertent entry of personnel into the restricted areas, but shall allow safe and unobstructed entry of site Operations personnel to perform operations and maintenance activities. Contractor shall be responsible for good housekeeping practices, and shall ensure that all operational doorways, electrical panels, control panels, etc. are unobstructed by stored or staged materials and equipment. The Contractor shall immediately report any instances of unauthorized personnel entering such areas, or any instances of improper PPE use within the areas.

The Contractor shall be responsible for the handling, protection, and storage of all material and equipment. NASA, at their discretion, shall inspect each construction site for compliance with OSHA, NEC, and the Life Safety Code. Any identified discrepancies shall be immediately corrected by the Contractor.

### 3.5 SALVAGE MATERIAL AND EQUIPMENT

Items of material designated by the Contracting Officer to be salvage shall remain the property of the Government.

It shall be segregated, itemized, delivered, and off-loaded at the Government designated storage area located within 5 miles of the construction site.

The Contractor shall maintain property control records for material or equipment designated as salvage. The Contractor's system of property control may be used if approved by the Contracting Officer. The Contractor shall be responsible for storage and protection of salvaged materials and equipment until disposition by the Contracting Officer.

### 3.6 PRESERVATION OF HISTORICAL AND ARCHAEOLOGICAL RESOURCES

If known historical, archaeological and cultural resources exist within the Contractor's work area, they have been designated on the contract drawings. The Contractor shall install protection for these resources as shown on the drawings and shall be responsible for their preservation during the contract.

If, during construction activities, the Contractor observes items that might have historical or archaeological value, such observations shall be reported immediately to the Contracting Officer so that the appropriate authorities may be notified and a determination can be made as to their significance and what, if any, special disposition of the finds shall be made. The Contractor shall cease all activities that may result in the

destruction of these resources and shall prevent his/her employees from trespassing on, removing, or otherwise damaging such resources.

-- End of Section --

## SECTION 01061

## PROJECT/CONTRACT SAFETY AND ENVIRONMENTAL REQUIREMENTS AND GUIDELINES

## PART 1 GENERAL

## 1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

## 1.2 REFERENCES

The publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

## EXECUTIVE ORDERS

- |            |   |
|------------|---|
| E.O. 13101 | Greening the Government Through Waste Prevention, Recycling and Federal Acquisition |
| E.O. 13148 | Greening the Government through Leadership in Environmental Management              |

## NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

- |            |                           |
|------------|---------------------------|
| NPR 8715.3 | (2004) NASA Safety Manual |
|------------|---------------------------|

## STATE REGULATIONS

Regulations for Control of Radiation in Mississippi, Division of Radiological Health, Bureau of Environmental Health, State Department of Health, Jackson, Mississippi.

- |                 |   |
|-----------------|---|
| Section 49-17-1 | (et seq., Mississippi Code of 1972) Mississippi Air and Water Pollution Control Law, and the regulations and standards adopted and promulgated thereunder |
| Section 402(b)  | of the Federal Water Pollution Control Act and the Federal Clean Air Act  |

## STENNIS PROCEDURES AND GUIDELINES (SPG)

- |            |  |
|------------|--|
| SPG 8715.1 | (1998) SSC Safety and Health Procedures and Guidelines |
|------------|--|

## STENNIS WORK INSTRUCTION (SWI)

- |                    |  |
|--------------------|--|
| SCWI-8500-0004-ENV | SSC Hazardous Material, Hazardous Waste, And Solid Waste Procedures and Guidelines |
| SCWI-8500-0020-ENV | Environmental Integrated Contingency Plan  |

SWI-1740-0022	(2000) Ionizing Radiation Safety Procedures
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
10 CFR Part 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 112	Oil Pollution Prevention
40 CFR 122	The National Pollutant Discharge Elimination System (NPDES)
40 CFR 257	Criteria for Classification of Solid Waste Disposal Facilities and Practices
40 CFR 258	Criteria for Municipal Solid Waste Landfills
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions
40 CFR 763	Asbestos
40 CFR 82	Protection of Stratospheric Ozone
43 CFR 7	Protection of Archaeological Resources
49 CFR Chapter I	Department of Transportation Regulations for Transporting Radioactive Sources

### 1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

#### SD-01 Preconstruction Submittals

- Safety Plan
- Activity Hazard Analysis

#### SD-03 Product Data

- Material Safety Data Sheets

#### SD-07 Certificates

- Mishap Exposure Report

#### SD-11 Closeout Submittals

## Affirmative Procurement Materials List Report

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

## 3.1 GENERAL SAFETY PROVISIONS

The project superintendent or designated safety representative is required to attend a mandatory safety meeting held on the first Tuesday of each month. These meetings will be used to address various safety topics and typically will last less than 30 minutes. The time and location for this meeting will be discussed during the pre-construction meeting held before work is to begin.

In order to provide accurate mishap statistics, the Contractor shall be required to complete a Mishap Exposure Report each month and submit the report via e-mail or fax to the Appropriate Configuration Coordinator for the project. The submitted copy shall arrive no later than two (2) working days after the close of each calendar month that the Contractor/Subcontractor is working on site at SSC. This report will be immediately forwarded from the Configuration Coordinator via e-mail or fax to the cognizant safety office over the Contractor (FOSC/NASA safety office). The report shall include the Contractor/Subcontractor name, number of employees on site, total man hours on site, and any incidents (by type) on site that may have occurred. It is the Contractor's responsibility to obtain this same information from all their lower tier subcontractors, and submit their reports along with the subcontractor's submittals each month. Should there be no mishaps to report, the Contractor is still required to submit a negative report. The types of mishaps to report will be discussed during the Pre-construction meeting held before work is to begin.

The Contractor shall take safety and health measures in performing work under this Contract. The Contractor is subject to applicable federal, state, and local laws, regulations, ordinances, codes, and orders relating to safety and health in effect on the date of this Contract.

During the performance of work under this Contract, the Contractor shall comply with procedures prescribed for control and safety of persons visiting the project site. The Contractor is responsible for his personnel and for familiarizing each of his subcontractors with safety requirements. The Contractor shall advise the Contracting Officer of any special safety restriction he has established so that Government personnel can be notified of these restrictions.

## 3.2 LOCK AND TAG PROCEDURES

## 3.2.1 General

These procedures apply to persons performing work at the site who install, repair, maintain, or inspect electrical apparatus, mechanical apparatus, or pressure systems.

Contractor shall assure that each employee is familiar with these procedures and that there is compliance with the procedures.

These procedures also apply to:

All major facility systems such as high-voltage instrumentation, air

compressing stations, and similar equipment;

Service facilities such as electrical substations, electrical distribution systems, underground utilities, and heat and refrigeration systems;

Cryogenic, combustible gas, vacuum, compressed air, or other compressed gas systems; such systems include compressors, storage facilities, transfer or distribution facilities, and other components thereof;

All other systems and equipment which would be hazardous if these procedures are not complied with;

It is the responsibility of the Contracting Officer, at the request of the Contractor, to apply locks and tags necessary to make the particular equipment safe to work on. The Contractor shall be responsible to ensuring that the system is safe.

Contractor shall furnish proof of compliance with 29 CFR 1910.147 including verification that each employee has been trained in the procedure set forth by the Contractor for locking the various equipment. The locks used by the Contractor must be plainly marked and identifiable as to who placed these locks.

The Contractor must furnish the Contracting Officer with a written procedure to be followed by Contractor's employees.

### 3.2.2 Mechanical and Electrical Procedures

Locks and tags will be used to prevent electrical switches, air and fluid valves, or similar control devices from being operated, when such operation could result in injury to personnel or damage to equipment. In particular, the vent valves for pressurized systems will be tagged open before any work is done on any pressurized system to relieve differential pressure completely.

No person, regardless of position or authority, shall operate any switch, valve, or equipment which has been locked and tagged.

When it is required that certain equipment be locked and tagged, the Contracting Officer will have an authorized Government safety operator in conjunction with the Contractor review the characteristics of the various systems involved that affect the safety of the operations and the work to be done; and will take all the necessary actions, to make the system and equipment safe to work on. The authorized Government operator will apply such locks and tags to those switches, or other devices needed to preserve the safety provided. This operation is referred to as "Providing Safety Clearance."

Once locks and tags have been applied by the Government, it is the responsibility of the Contractor to immediately apply his own locks, tags and grounds. The Contractor shall not apply his locks, tags and grounds before locks and tags are applied by the Government. The Contractor shall not start work on the equipment until both the Government's locks and tags and his own locks, tags and grounds are in place.

If more than one group is to work on any circuit or equipment, the employee in charge of each group shall have a separate set of locks and tags properly attached.

It is the responsibility of the Contractor and the workmen performing the work to verify that the system is deenergized at the point of work.

When any individual or group has completed its part of the work and is clear of the circuits or equipment, the supervisor, project leader, or individual for whom the equipment was tagged shall notify the Contracting Officer. The Government operator shall be responsible for the physical removal of the Government's locks and tags, and the Contractor shall be responsible for removal of his own locks, tags and grounds. The Contractor shall remove his locks, tags and grounds before the locks and tags of the Government are removed.

### 3.3 SAFETY PLAN

The Contractor shall submit a safety plan to the Contracting Officer with their proposal. Compliance to the NASA/SSC Safety Procedures will be met. This document will be made available upon request from the Contracting Officer.

The safety plan shall include, as a minimum, the following:

- a. Safety program objectives.
- b. Methods to attain safety objectives.
- c. Responsibility of key personnel for the Contractor.
- d. Safety meetings, surveys, inspections, and reports.
- e. Disaster and emergency programs.
- f. Lists of key personnel to be contacted in times of emergency.
- g. Program to show compliance with Federal OSHA Safety and Health Standards 29 CFR 1910 and 29 CFR 1926 and various safety requirements of NPR 8715.3 and SPG 8715.1.
- h. Methods to comply with the requirement for immediate reporting of accidents to the Contracting Officer.
- i. Statement that the Contractor will not invalidate the integrity of safety systems without proper authorization.
- j. Procedures for emergency actions to be taken to secure dangerous conditions, to protect personnel, and secure work areas in the event of accident or an act of nature.
- k. Procedures for securing the accident site so that the area remains secure until arrival of a safety investigator. The accident site will remain secured until released by the Contracting Officer.
- l. Provisions for hard hats, safety shoes and eye protection.
- m. Written procedures for lock and tag operations.

### 3.4 ACTIVITY HAZARD ANALYSIS

An Activity Hazard Analysis shall be completed prior to commencement of

work activities and prior to submission of the Safety and Health Plan.

The Activity Hazard Analysis shall include details on the specific scope of work under the contract. Specific safety and health measures necessary to mitigate hazards identified by the Activity Hazard Analysis shall be documented in the Safety and Health Plan. The Activity Hazard Analysis shall be included in the Safety and Health Plan for review and acceptance.

The Activity Hazard Analysis shall conform to NASA SPG 8715.1 current revision. This shall be made available to the Contractor from the Client Contracting Officer upon request.

### 3.5 ACCIDENT TREATMENT AND RECORDS

Contractor shall post emergency first aid and ambulance information at project site.

SSC maintains a medical dispensary for minor injury and emergency medical treatment that may be used by the Contractor. This service is available during normal work days and work hours. In addition, SSC maintains Emergency Ambulance Service on a continuous 24 hours, 7 days a week basis. Telephone numbers for these services are as follows:

Emergency Medical/Ambulance Service	
On site telephones only .....	911
If you do not have access to an	
on-site telephone .....	(228) 688-3636
Non-emergency	
Medical services (normal working hours)...	Extension 83810
From an off-site telephone	
(normal working hours) .....	(228) 688-3810
From an off-site telephone	
(after normal working hours) .....	(228) 688-3639

Note: Due to certain security measures in effect in various areas at SSC, it is recommended that the above numbers be used in case of an emergency. Any other method may result in response delays by the notified emergency personnel.

### 3.6 FIRE PREVENTION AND PROTECTION

Open-flame heating devices will not be permitted except by approval in writing from the Contracting Officer. Approval for the use of open fires and open-flame heating devices will not relieve the Contractor from the responsibility for any damage incurred because of fires.

Burning trash, brush, or wood on the project site shall not be permitted.

### 3.7 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site.

### 3.8 ELECTRICAL

The Contractor shall appoint an individual responsible for the electrical safety of each work team to restrict entry to dangerous locations to those authorized by him jointly with the Government.

### 3.9 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

### 3.10 ROOFING AND COATING

At the beginning of each work day the Contractor shall check with the Contracting Officer before proceeding to work on the roof to ensure safe work conditions.

### 3.11 EXCAVATION

Several historically sensitive areas as defined in 43 CFR 7 and CERCLA clean up sites are located onsite. The Contracting Officer shall verify whether the proposed excavation is located within the boundary of these areas. The NASA Environmental Office, through the Contracting Officer, must be contacted prior to any excavation within these areas.

Prior to performing any excavation work or any surface penetrations 6 inches or deeper (such as driving stakes more than 6 inches in the ground) on any ground surface, the Contractor shall obtain a Dig Permit. The Contractor shall stake out subsurface high voltage cables, communication cables, and pipe lines indicated within the scope of the work contemplated. After exposure, the Contractor shall obtain agreement from the Contracting Officer on how much closer to cable or pipe the excavations can be permitted.

### 3.12 WELDING, FLAME CUTTING, AND MELTING

The Contractor shall clear welding and cutting operations with the Contracting Officer before operations begin.

The Contractor shall discontinue burning, welding, or cutting operations 1 hour prior to the end of the normal work day. A workman shall remain at the site for 1 hour after discontinuing these operations to make thorough inspection of the area for possible sources of latent combustion. He shall be equipped with two full 15-pound carbon dioxide fire extinguishers. Any unsafe conditions shall be reported to the Center Fire Station. (From an on-site phone, dial 911 or 83639; from an off-site phone, dial (228) 688-3639.)

During operations involving possible fire hazard, the Contractor shall notify the Contracting Officer and not proceed until clearance is obtained in writing. The Contracting Officer may request a standby from the Fire Station. This requirement does not relieve the Contractor of his responsibility for welding and cutting safety.

### 3.13 FALL PROTECTION

Per OSHA requirement, employees shall be protected from falling any time they work on a surface that exposes them to a vertical drop of 6 feet or more to a lower level. The project safety plan provided by the contractor shall incorporate the required employee fall protection procedures, as outlined in the OSHA standard 29 CFR 1926 subpart M. The plan will be approved by the center prior to any work commencing.

Per Stennis Space Center's safety manual, SPG 8715.1, the Contractor must

also comply with the following in addition to the OSHA standard:

- Roofing work on Low-slope roofs: Although OSHA allows the use of a warning line system and safety monitoring system as the only means of fall protection, this practice is not allowed at Stennis Space Center. Other means of fall protection, such as guardrail systems, safety net system, or personal fall arrest systems are required.
- Body belts shall not be used at SSC as a means of fall protection.
- Non-locking snap hooks are not allowed at SSC.
- Do not tie off to any roof structure that is not specifically designed as an anchorage point or has been approved for use by a qualified person.

### 3.14 HIGH NOISE LEVEL PROTECTION

Operations performed by the Contractor that involve the use of equipment with output of high noise levels (jackhammers, air compressors, and explosive device activated tools) shall be scheduled for weekends or after duty working hours. Use of any such equipment shall be approved in writing by the Contracting Officer prior to commencement of work.

### 3.15 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor shall:

- a. Secure outside equipment and materials and place materials subject to damage in protected locations.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- c. Ensure that temporary erosion controls are adequate.

### 3.16 HAZARDOUS WASTE

The Contractor shall identify all wastes produced and dispose of them in the following approved manners:

Identify all wastes and waste producing processes including chemicals, paints, POL products and solvents, and their containers. All aerosol cans shall be considered hazardous waste and disposed of accordingly.

Obtain a determination of whether the waste is hazardous from the Contracting Officer as required by 40 CFR 261.

Notify the Contracting Officer prior to taking disposal action for any hazardous waste.

For disposal, provide either laboratory analysis data documenting the chemical content of the waste or certification by appropriate organization authority as to the chemical constituents of the waste. Technical assistance on disposal analysis requirements will be provided on request by contacting the Contracting Officer.

Document the waste type, quantity, location, and personnel/contractor/

agency responsible so the material can be tracked from generation through ultimate disposal as required by Environmental Protection Agency under the Resource Conservation and Recovery Act.

### 3.17 MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets (MSDS's) for all hazardous materials proposed for use at SSC must be provided to the Contracting Officer for submission to the FOSC Environmental Services Office PRIOR TO THE DELIVERY OF THE HAZARDOUS MATERIALS AT SSC. Additionally, the Contractor must ensure compliance with the OSHA Hazard Communication Standard (29 CFR 1910.1200).

It is the Contractor's responsibility to ensure that all MSDS requirements and recommendations are understood and followed by personnel using hazardous materials. The Contractor shall provide adequate controls to ensure that SSC personnel are not exposed to hazardous materials and to ensure the protection of the SSC environment.

### 3.18 AFFIRMATIVE PROCUREMENT

E.O. 13101 requires that certain EPA designated items purchased for use at SSC contain recycled materials. For a list of these items and requirements, contact the Contracting Officer. These items and details on the required recycled content may also be found at <http://www.epa.gov/cpg/products.htm>. On completion of the project an Affirmative Procurement Materials List Report shall be submitted to the Contracting Office. The report shall include: the total amount of designated items used, the total cost, the total amount of item used containing recycled materials, the total cost of item used containing recycled materials. Items include concrete, insulation, carpet and others.

### 3.19 EROSION CONTROL FOR CONSTRUCTION PROJECTS

The Contractor shall follow the provisions of the Mississippi Water Pollution Control Law (Section 49-17-1 et seq., Mississippi Code of 1972), and the regulations and standards adopted and promulgated thereunder, and under authority granted pursuant to Section 402(b) of the Federal Water Pollution Control Act. The contractor shall utilize best management practices to control erosion from work site areas including select vegetative and structural controls; good housekeeping; and post construction/storm water management measures & controls.

### 3.20 LANDSCAPING USING NATIVE PLANT SPECIES

E.O. 13148 requires that when landscaping on SSC property, the Contractor shall use regionally native plants and minimize adverse effects on natural habitats encountered during the project. When applicable, additional information will be provided.

### 3.21 SPILL PREVENTION AND RESPONSE

Adequate containment must be provided for all liquid material and waste as required in 40 CFR 112 and SCWI-8500-0020-ENV. The containment area must be of adequate size to contain the volume of the largest drum or other container in the containment. All liquid waste must be stored on spill containment pallets (SCPs), whether stored inside or outside. All individual containers of new/usable products greater than 30 gallons in capacity must be stored on SCPs inside or outside building. SCPs are not required inside, only if engineering controls are used to make sure that

spilled materials cannot enter the floor drains or otherwise be released to the outside of the building. SCPs must also be used both inside and outside for the storage of any liquid in a container which is flimsy, damaged or otherwise likely to release its contents. SCPs, drain pans, spill/absorbent pads, etc. must also be used inside and outside as appropriate to minimize spillage during dispensing/transfer operations. All SCPs in outside locations must be covered as necessary to prevent/minimize the potential for water to accumulate in the pallet.

Waterborne operations require special precautions to prevent spills directly into waters at SSC. Spill prevention measures must be planned ahead of time and may require the placement of booms, the stationing of absorbent pads, etc. prior to the commencement of work.

If a spill of any size occurs, the Contractor shall immediately contact the Fire Department at 911 (onsite) or 688-3636.

### 3.22 WASTEWATER DISPOSAL GUIDELINES

Wastewater generated during the course of any project shall not be disposed of in ditches or other onsite grounds. Chemical waste and wastewater contaminated with chemicals shall not be poured down drains or disposed of in sinks. Discharges of these substances are prevented by 40 CFR 122 and SCWI-8500-0004-ENV. Technical guidance on specific wastewater issues shall be provided by the Contracting Officer, as requested.

### 3.23 SOLID WASTE DISPOSAL GUIDELINES

Solid waste includes all discarded or inherently waste-like materials. This definition may include solids, liquids, semi-solids and materials collected for recycling as defined in 40 CFR 257 and 40 CFR 258.

Smaller quantities of solid waste can be disposed of in dumpsters located throughout the site. No containers containing, or having contained, hazardous or contaminated materials (paints, thinners, chemicals, etc.) will be disposed of in the dumpsters.

Larger loads shall be transported to the landfill for disposal. All disposal at the landfill must be personally approved of by the landfill operator. Wood designated for disposal must be segregated into treated (painted, coated) and untreated categories.

### 3.24 ABRASIVE BLASTING GUIDELINES

Only non-silica abrasives are allowed for use at SSC. All abrasive blast material (blast media and waste material) shall be contained in the area of the blasting operation. Some means of collection must be provided by the Contractor for the blast material and clean-up must be performed on an appropriate frequency to prevent the build up and release of blast material into the environment. It shall be the responsibility of the Contractor to collect all abrasive blast material for disposal.

Prior to disposal, the blast waste material must be characterized by testing to determine if it is hazardous or non-hazardous. If hazardous, the collected abrasive blast material will be turned over to the Contracting Officer for disposal. If non-hazardous, the abrasive blast shall be taken to the landfill by the Contractor, to be disposed of as solid waste. All disposal at the landfill must be personally approved of by the landfill operator.

If any unforeseen disposal issues are discovered at the time of waste characterization, the waste material shall be disposed of in accordance with guidelines set forth by the Contracting Officer.

### 3.25 RECYCLING

The Contractor shall recycle products used on any project to the maximum extent possible. All recycling arrangements will be coordinated with the Contracting Officer.

### 3.26 PCB MANAGEMENT

All maintenance activities or removal operations concerning PCB contaminated materials must comply with the requirements of 40 CFR 761 and be coordinated with the Contracting Officer. The Contractor must provide adequate spill protection and material management to prevent the release of PCB's to the environment. Requests for technical guidance concerning the disposition, management and disposal of all PCB contaminated materials shall be coordinated with the Contracting Officer.

### 3.27 REMOVAL OF EQUIPMENT OR SYSTEMS CONTAINING CHLOROFLUOROCARBONS (CFC)

All maintenance activities or removal operations on equipment or systems containing CFCs (Freon, halon, etc.) must comply with the requirements of 40 CFR 82 and shall be coordinated with the Contracting Officer. All CFCs must be removed from the containing system prior to equipment removal and may be required prior to various maintenance activities. Permission to remove CFC containing systems must be gained from the Contracting Officer prior to removal.

### 3.28 PAINTING OPERATIONS

All liquid oil-based paint must be thoroughly drained from the paint cans and buckets by inverting the containers on the drum funnel (or using the can crusher). Empty cans will be crushed and placed in a designated container. Containers with liquid waste cannot be placed in either the empty metal can bin or the landfill bin.

Used spray cans will be bagged and stored in a container. Used brushes, plastic containers, and paint cans that have more than 1/2 inch thickness of paint in the bottom must be bagged and placed in a separate container for landfill disposal. Latex paint waste must be clearly labeled as "Waste Latex Paint". Empty metal latex paint cans will also be crushed and placed in a container.

If using enamel paints, other oil-based paints, thinners or other flammable substances, rules governing the disposal of hazardous waste shall be followed. The Contracting Officer shall provide guidance on the establishment, requirements and management of satellite accumulation areas (SAA) for the management of hazardous waste and subsequent disposal, as appropriate.

General requirements include:

All containers holding 30 gallons or greater are required to be on spill pallets and protected from the elements.

Oily rags and aerosol cans must be collected in a designated location

and containers must be clearly marked.

Empty drums shall not be stored among those that are used for waste storage.

All drums must be labeled, unless completely empty.

"No Smoking" signs shall be posted in each area where flammable materials are stored.

All work areas shall be kept clean and orderly.

Storage of hazardous materials shall be minimized.

### 3.29 INDUSTRIAL RADIOGRAPHY

Any Contractor performing Industrial Radiography at SSC shall submit a current safety manual and radioactive material license to the Contracting Officer prior to bringing any radioactive material on site. All radiographers must possess a Mississippi State radioactive material license to perform industrial radiography at SSC. Contractors shall conform to the provisions in 10 CFR Part 20 and 49 CFR Chapter I, and the Stennis Work Instruction, SWI-1740-0022.

### 3.30 ASBESTOS DISTURBANCE

Portions of Buildings 1100, 1000, 1200, 2101 and 2201 contain asbestos spray applied insulation on the underside of the roof structure and intermediate floors. Work performed in these areas that involves the removal of ceiling tiles and/or work in these ceiling spaces must be performed in accordance with asbestos work requirements established in the NASA/SSC Asbestos Hazard Control Plan and 40 CFR 763. Also, our Mechanical Equipment Rooms and many of our piping/duct systems at SSC are insulated with asbestos thermal system insulation. Any disturbance of these insulating systems must be performed in accordance with the NASA/SSC Asbestos Hazard Control Plan and applicable regulatory requirements. In the event that work in, adjacent to or involving any of these insulating systems/areas should become necessary as part of the performance of this contract, ensure that the Contracting Officer is notified for prior clearance and to verify whether or not asbestos is involved.

-- End of Section --

## SECTION 01330

## SUBMITTAL PROCEDURES

## PART 1 GENERAL

## 1.1 SUMMARY

Requirements of this Section apply to, and are a component part of, each section of the specifications.

## 1.2 SUBMITTALS

A standard transmittal form provided by the Government, SSC Form 581, shall be used to transmit each submittal.

Submittal Description (SD): Drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials to be furnished by the Contractor explaining in detail specific portions of the work required by the contract.

The following items, SD-01 through SD-11, are descriptions of data to be submitted for the project. The requirements to actually furnish the applicable items will be called out in each specification.

## SD-01 Preconstruction Submittals

Submittals which are required prior to a notice to proceed on a new contract. Submittals required prior to the start of the next major phase of the construction on a multi-phase contract. Schedules or tabular list of data or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work, submitted prior to contract notice to proceed or next major phase of construction.

## SD-02 Shop Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work.

## SD-03 Product Data

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

## SD-04 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

## SD-06 Test Reports

Written reports of a manufacturer's findings of his product during

field inspections, attesting that the products are installed in accordance with the manufacturer's installation instructions, shop drawings, or other manufacturer's requirements. Written reports by a general contractor or his subcontractors including daily logs reporting on the progress of daily activities or attesting that the work has been installed in accordance with the contract plans and specifications.

#### SD-07 Certificates

A document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other Lower Tier Contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality.

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meet specified requirements. Statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system, or material, including special notices and material safety data sheets, if any concerning impedances, hazards, and safety precautions.

#### SD-10 Operation and Maintenance Data

Data intended to be incorporated in an operations and maintenance manual.

#### SD-11 Closeout Submittals

Special requirements necessary to properly close out a construction contract. For example, as-built drawings, manufacturer's help and product lines necessary to maintain and install equipment. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

### 1.3 PREPARATION

#### 1.3.1 Marking

Permanent marking shall be provided on each submittal to identify it by contract number; transmittal date; Contractor's, Subcontractor's, and supplier's name, address(es) and telephone number(s); submittal name; specification or drawing reference; and similar information to distinguish it from other submittals. Submittal identification shall include space to receive the review action by the Contracting Officer.

#### 1.3.2 Drawing Format

Drawing submittals shall be prepared on bond (20 lb. bond minimum) paper, not less than 8-1/2 by 11 inches nor larger than 30 by 42 inches in size, except for full size patterns or templates. Drawings shall be prepared to accurate size, with scale indicated, unless other form is required. Drawing reproducibles shall be suitable for microfilming and reproduction

and shall be of a quality to produce clear, distinct lines and letters. Drawings shall have dark lines on a white background.

Copies of each drawing shall have the following information clearly marked thereon:

- a. Job name, which shall be the general title of the contract drawings.
- b. Date of the drawings and revisions.
- c. Name of Contractor.
- d. Name of Subcontractor.
- e. Name of the item, material, or equipment detailed thereon.
- f. Number of the submittal (e.g., first submittal, etc.) in a uniform location adjacent to the title block.
- g. Government contract number shall appear in the margin, immediately below the title block.

Drawings shall be numbered in logical sequence. Contractor may use his own number system. Each drawing shall bear the number of the submittal in a uniform location adjacent to the title block. Government contract number shall appear in the margin, immediately below the title block, for each drawing.

A blank space, no smaller than 4 X 4 inches shall be reserved on the right hand side of each sheet for the Government disposition stamp.

#### 1.3.3 Data Format

Required data submittals for each specific material, product, unit of work, or system shall be collected into a single submittal and marked for choices, options, and portions applicable to the submittal. Marking of each copy of product data submitted shall be identical. Partial submittals will not be accepted for expedition of construction effort.

#### 1.3.4 Samples

Samples shall be physically identical with the proposed material or product to be incorporated in the work, fully fabricated and finished in the specified manner, and full scale. Where variations in color, finish, pattern, or texture are inherent in the material or product represented by the sample, multiple units of the sample, showing the near-limits of the variations and the "average" of the whole range (not less than 3 units), shall be submitted. Each unit shall be marked to describe its relation to the range of the variation. Where samples are specified for selection of color, finish, pattern, or texture, the full set of available choices shall be submitted for the material or product specified. Sizes and quantities of samples shall represent their respective standard unit.

### 1.4 SUBMISSION REQUIREMENTS

#### 1.4.1 Schedules

Within 21 days of notice to proceed, the Contractor shall provide, for

approval by the Contracting Officer, the following schedule of submittals:

- a. A schedule of shop drawings and technical submittals required by the specifications and drawings. Schedule shall indicate the specification or drawing reference requiring the submittal; the material, item, or process for which the submittal is required; the "SD" number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date.
- b. A separate schedule of other submittals required under the contract but not listed in the specifications or drawings. Schedule will indicate the contract requirement reference; the type or title of the submittal; the Contractor's anticipated submission date and the approved need date (if approval is required).
- c. Submittals called for by the contract documents will be listed on one of the above schedules. If a submittal is called for but does not pertain to the contract work, the Contractor shall include it in the applicable schedule and annotate it "N/A" with a brief explanation. Approval of the schedules by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the schedules or marked "N/A".
- d. Copies of both schedules shall be re-submitted monthly annotated by the Contractor with actual submission and approval dates. When all items on a schedule have been fully approved, no further re-submittal of the schedule is required.

#### 1.4.2 Drawings Submittals

Six blackline prints of each drawing shall be submitted. One print, marked with review notations by the Contracting Officer, will be returned to the Contractor.

#### 1.4.3 Data Submittals

Five complete sets of indexed and bound product data shall be submitted. One set, marked with review notations by the Contracting Officer, will be returned to the Contractor.

#### 1.4.4 Samples

Two sets of identified samples shall be submitted. A copy of the transmittal form, marked with review notations including selections by the Contracting Officer, will be returned to the Contractor.

Samples that are intended or permitted to be returned and actually incorporated in the work are so indicated in the individual technical sections. These samples will be returned to the Contractor, at his expense, to be clearly labeled, with installation location recorded. Samples shall be in undamaged condition at the time of installation.

Where mockups and similar large samples are required by individual technical sections, it is recognized that these are a special type of sample which cannot be readily "transmitted" as specified for submittal of samples. Otherwise, and except as indicated in the individual technical

sections, the requirements for samples shall be complied with and a transmittal form shall be processed for each mockup, to provide a record of the activity.

## 1.5 GOVERNMENT'S REVIEW

### 1.5.1 Review Notations

Contracting Officer will review submittals and provide pertinent notation within 14 calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "Approved as Submitted." authorize the Contractor to proceed with the work covered.
- b. Submittals marked "Approved, Except as Noted, Resubmission Not Required." authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections. Notes shall be incorporated prior to submission of the final submittal.
- c. Submittals marked "Approved, Except as Noted, Resubmission Required." require the Contractor to make the necessary corrections and revisions and to re-submit them for approval in the same routine as before, prior to proceeding with any of the work depicted by the submittal.
- d. Submittals marked "Will Be Returned By Separate Correspondence" require the Contractor to follow the instructions given in the separate correspondence. If re-submission is required, the Contractor shall re-submit them for approval in the same routine as before prior to proceeding with any of the work depicted by the submittal.
- e. Submittals marked "Disapproved" indicate noncompliance with the contract requirements and shall be re-submitted with appropriate changes. No item of work requiring a submittal shall be accomplished until the submittals are approved or approved as noted.
- f. Submittals marked "Receipt Acknowledged" confirm receipt only.
- g. Submittals marked "Other (Specify)" require the Contractor to follow the instructions given in the separate correspondence. If re-submission is required, the Contractor shall re-submit them for approval in the same routine as before, prior to proceeding with any of the work depicted by the submittal.

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes in Contract Documentation" shall be given to the Contracting Officer. Approval of the submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is satisfactory. Contractor shall be responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to approved submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change shall be accomplished until the changed submittals are approved.

#### 1.5.2 Sample Approval

Contractor shall furnish, for the approval of the Contracting Officer, samples required by the specifications or by the Contracting Officer. Shipping charges shall be paid by the Contractor. Materials or equipment requiring sample approval shall not be delivered to the site or used in the work until approved in writing by the Contracting Officer.

Each sample shall have a label indicating:

- a. Name of project
- b. Name of Contractor
- c. Material or equipment
- d. Place of origin
- e. Name of producer and brand
- f. Specification section to which samples applies
- g. Samples of furnished material shall have additional markings that will identify them under the finished schedules.

Contractor shall submit to the Contracting Officer two samples of materials where samples are requested. Contractor shall transmit with each sample a letter, original and two copies, containing the above information.

Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any contract requirements. Before submitting samples, the Contractor shall assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Materials and equipment incorporated in the work shall match the approved samples. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at his expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Variations from contract requirements shall be specifically pointed out in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor shall replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer shall not relieve the Contractor of his responsibilities under the contract.

#### 1.6 PROGRESS SCHEDULE

##### 1.6.1 Bar Chart

Contractor shall:

- a. Submit the progress chart, for approval by the Contracting Officer, within 21 days of Notice to Proceed, in one reproducible and 4 copies.
- b. Prepare the progress chart in the form of a bar chart utilizing form "Construction Progress Chart" or comparable format acceptable to the Contracting Officer.
- c. Include no less than the following information on the progress chart:
  - (1) Break out by major headings for primary work activity.
  - (2) A line item break out under each major heading sufficient to track the progress of the work.
  - (3) A line item showing contract finalization task which includes punch list, clean-up and demolition, and final construction drawings.
  - (4) A materials bar and a separate labor bar for each line item. Both bars will show the scheduled percentage complete for any given date within the contract performance period. Labor bar will also show the number of men (man-load) expected to be working on any given date within the contract performance period.
  - (5) The estimated cost and percentage weight of total contract cost for each materials and labor bar on the chart.
  - (6) Separate line items for mobilization and drawing submittal and approval. (These items are to show no associated costs.)
- d. Update the progress schedule in one reproduction and 4 copies every 30 days throughout the contract performance period.

#### 1.7 STATUS REPORT ON MATERIALS ORDERS

Within 21 days after notice to proceed, the Contractor shall submit, for approval by the Contracting Officer, an initial status report on materials orders. This report will be updated and re-submitted every 28 days as the status on material orders changes.

Report shall list, in chronological order by need date, materials orders necessary for completion of the contract. The following information will

be required for each material order listed:

- a. Material name, supplier, and invoice number.
- b. Bar chart line item or CPM activity number affected by the order.
- c. Delivery date needed to allow directly and indirectly related work to be completed within the contract performance period.
- d. Current delivery date agreed on by supplier.
- e. When item d exceeds item c, the effect that delayed delivery date will have on contract completion date.
- f. When item d exceeds item c, a summary of efforts made by the Contractor to expedite the delayed delivery date to bring it in line with the needed delivery date, including efforts made to place the order (or subcontract) with other suppliers.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

## SECTION 01420

## SOURCES FOR REFERENCE PUBLICATIONS

## PART 1 GENERAL

## 1.1 REFERENCES

Reference publications are cited in other sections of the specifications along with identification of their sponsoring organizations. The addresses of the sponsoring organizations are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
11 West 42nd St  
New York, NY 10036  
Ph: 212-642-4900  
Fax: 212-302-1286  
Internet: <http://www.ansi.org/>

ASTM INTERNATIONAL (ASTM)  
100 Barr Harbor Drive  
West Conshohocken, PA 19428-2959  
Ph: 610-832-9500  
Fax: 610-832-9555  
Internet: [www.astm.org](http://www.astm.org)

ELECTRONIC INDUSTRIES ALLIANCE (EIA)  
2500 Wilson Blvd.  
Arlington, VA 22201-3834  
Ph: 703-907-7500  
Fax: 703-907-7501  
Internet: [www.eia.org](http://www.eia.org)

EXECUTIVE ORDERS  
Contact:  
Marcia Stewart  
Environmental Services  
B-2104  
Stennis Space Center, MS 39529  
Ph: 228-688-1302

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)  
445 Hoes Ln, P. O. Box 1331  
Piscataway, NJ 08855-1331  
Ph: 732-981-0060 OR 800-701-4333  
Fax: 732-981-9667  
Internet: <http://www.standards.ieee.org>  
E-mail: [customer.service@ieee.org](mailto:customer.service@ieee.org)

IPI - ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES (IPC)  
2215 Sanders Rd.  
Northbrook, IL 60062-6135  
Ph: 847-509-9700  
Fax: 847-509-9798  
Internet: [www.ipc.org](http://www.ipc.org)

e-mail: [orderipc@ipc.org](mailto:orderipc@ipc.org)

JOINT INDUSTRIAL COUNCIL (JIC)  
Association for Manufacturing Technology  
7901 Westpark Dr.  
McLean, VA 22102  
Ph: 703-893-2900  
Fax: 703-893-1151

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)  
Publication(s) Available From  
Superintendent of Documents  
U.S. Government Printing Office  
Washington, DC 20402  
Ph: 202-783-3238

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)  
1300 N. 17th St., Suite 1847  
Rosslyn, VA 22209  
Ph: 703-841-3200  
Fax: 202-841-3300  
Internet: <http://www.nema.org/>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)  
One Batterymarch Park  
P.O. Box 9101  
Quincy, MA 02269-9101  
Ph: 800-344-3555  
Fax: 800-593-6372  
Internet: <http://www.nfpa.org>

STATE REGULATIONS  
Contact:  
Marcia Stewart  
Environmental Services  
B-2104  
Stennis Space Center, MS 39529  
Ph: 228-688-1302

STENNIS PROCEDURES AND GUIDELINES (SPG)  
Central Engineering Files  
Building 2104  
Stennis Space Center, MS 39529  
Ph: 228-688-3043  
Fax: 228-688-3503

STENNIS WORK INSTRUCTION (SWI)  
Contact:  
Marcia Stewart  
Environmental Services  
B-2104  
Stennis Space Center, MS 39529  
Ph: 228-688-1302

UNDERWRITERS LABORATORIES (UL)  
333 Pfingsten Rd.  
Northbrook, IL 60062-2096  
Ph: 847-272-8800  
Fax: 847-272-8129

Internet: <http://www.ul.com/>  
Order from:  
Global Engineering Documents  
15 Inverness Way East  
Englewood, CO 80112-5776  
Ph: 800-569-7128  
Fax: 303-397-7945  
Internet: <http://global.ihs.com>  
E-mail: [global@ihs.com](mailto:global@ihs.com)

U.S. DEPARTMENT OF DEFENSE (DOD)  
Order DOD Documents from:  
National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
Ph: 703-605-6000  
FAX: 703-605-6900  
Internet: <http://www.ntis.gov>  
Order Military Specifications, Standards and Related Publications  
from:

Department of Defense Single Stock Point for (DODSSP)  
Defense Automation and Production Service (DAPS)  
Bldg 4D  
700 Robbins AV  
Philadelphia, PA 19111-5094  
Ph: 215-697-2179  
Fax: 215-697-1462  
Internet: <http://www.assistdocs.com>

U.S. GENERAL SERVICES ADMINISTRATION (GSA)  
General Services Administration  
1800 F Street, NW  
Washington, DC 20405  
PH: 202-501-0705  
Order from:  
General Services Administration  
Federal Supply Service Bureau  
1941 Jefferson Davis Highway  
Arlington, VA 22202  
PH: 703-605-5400  
Internet: <http://www.fss.gsa.gov>

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)  
700 Pennsylvania Avenue, N.W.  
Washington, D.C. 20408  
Phone: 866-325-7208  
Internet: <http://www.archives.gov>  
Order documents from:  
Superintendent of Documents  
U.S. Government Printing Office  
732 North Capitol Street, NW  
Washington, DC 20401  
Mailstop: SDE  
Ph: 866-512-1800 or 202-512-1800  
Fax: 202-512-2250  
Internet: <http://www.gpo.gov>  
E-mail: [gpoaccess@gpo.gov](mailto:gpoaccess@gpo.gov)

-- End of Section --

## SECTION 01780

## CLOSEOUT SUBMITTALS

## PART 1 GENERAL

## 1.1 SUMMARY

The requirements of this Section apply to, and are a component part of each section of the specifications.

## 1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with each section of the project's specification:

## SD-01 Preconstruction Submittals

The following shall be submitted in accordance with paragraph entitled, "General," of this section.

Reproducible Drawings  
CAD System Drawings

## SD-02 Shop Drawings

As-Built Drawings shall be submitted in accordance with paragraph entitled, "General," of this section.

## SD-03 Product Data

Spare Parts Data shall indicate manufacturer's name, part number, nomenclature, and stock level recommended for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

## SD-07 Certificates

A Work Plan shall be submitted in accordance with paragraph entitled, "General," of this section.

## SD-08 Manufacturer's Instructions

The following shall be submitted in accordance with paragraph entitled, "General," of this section.

Preventative Maintenance and Condition Monitoring (Predictive Testing) and Inspection schedules shall be submitted by the Contractor with instructions that state when systems should be retested.

Schedule shall define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements. Each test feature; e.g., gpm, rpm, psi, shall have a signoff blank for the Contractor and Contracting

Officer. A remarks column of the testing validation procedure shall include references to operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Procedures for preventative maintenance, condition monitoring (predictive testing) and inspection, adjustment, lubrication and cleaning necessary to prevent failure shall be delineated.

#### Posted Instructions

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

### 1.3 GENERAL

Reproducible Drawings and CAD System Drawings shall be submitted as follows:

Three (3) reproducible copies of each drawing, product data record, or log, 5.25 CAD system floppy disk showing each drawing, product data record, or log shall be submitted for historical record.

Final drawings shall incorporate contract changes and plan deviations. Lines, letters, and details will be sharp, clear, and legible. Additions or corrections to the drawings will be drawn to the scale of the original drawing. One copy, marked with review notations by the Contracting Officer, will be returned to the Contractor. Drawings are to be resubmitted within 30 calendar days after the completion of the representative work effort.

Documents shall be current. Contractor shall not conceal record information until as-built drawings have been made. Record drawings shall be submitted with a transmittal letter containing date, project title, Contractor's name and address, document list, and Contractor's signature.

As-Built Drawings shall be submitted under the following criteria:

In order to minimize the time for final payment at the completion of the project, the Contractor shall update the as-built drawings every month with the Contracting Officer's authorized representative. This update will be a part of "the monthly request for payment meeting," and payment--or a portion of the payment, including final payment--may be withheld until the as-built drawings have been updated, and accepted by the Contracting Officer.

After completion of all construction and before final payment is made under this contract, the Contractor shall provide the Contracting Officer with one complete set of CAD system drawings with all changes clearly identifiable on the computer screen along with one hard copy of the same (with advance permission given by the Contracting Officer).

Preventative Maintenance and Condition Monitoring (Predictive Testing) and Inspection schedules shall be submitted by the Contractor with instructions that state when systems should be retested.

Schedule shall define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements. Each test feature; e.g., gpm, rpm, psi, shall have a signoff blank for the Contractor and Contracting Officer. A remarks column of the testing validation procedure shall include references to operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair shall be delineated.

Repair requirements shall inform operators how to check out, troubleshoot, repair, and replace components of the system. Instructions shall include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

A Work Plan shall be submitted to the Contracting Officer for project closeout. Plan shall include all scheduled inspections, instruction classes, items, closeout dates for all functions, and shall list the required Government and Contractor personnel that will be taking part in these functions.

Posted Instructions shall be submitted by the Contractor with labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Contractor shall submit 6 copies of the project operation and maintenance manuals 30 days prior to testing the system involved. Data shall be updated and resubmitted for final approval no later than 30 days prior to contract completion.

Spare Parts Data shall indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

### 3.1 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals shall be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Information shall be bound in manual format and grouped by technical sections. Test data shall be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals shall have 0.3937-inch holes and be bound in 3-ring, loose-leaf binders. Data shall be organized by separate index and tabbed sheets, in a loose-leaf binder. Binder shall lie flat with printed sheets that are easy to read. Caution and warning indications shall be clearly labeled.

Contractor shall submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical

provisions. These services shall be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer shall be given 7 days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, shall be made available to the Contracting Officer.

-- End of Section --

## SECTION 16003

## GENERAL ELECTRICAL PROVISIONS

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.1 (2002) Safety Color Code

## ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

## U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-T-704 (Rev K) Treatment and Painting of Material

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-59214 (2004) Junction Box: Extension, Junction Box; Cover, Junction Box (Steel, Coated With Corrosion-Resistant Finish)

## UNDERWRITERS LABORATORIES (UL)

UL Elec Const Dir (2003) Electrical Construction Equipment Directory

## 1.2 SUBMITTALS

Not Used

## 1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

It is the intent of these specifications and the contract drawings to provide a complete and workable facility.

Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other specific elements that may be required for proper installation of the work. Such work shall be verified at the site. Additional bends and offsets, and conduit as required by vertical and horizontal equipment locations or other job conditions, shall be provided

to complete the work at no additional cost to the Government.

Except where shown in dimensional detail, the locations of switches, receptacles, lights, motors, outlets, and other equipment shown on plans are approximate. Such items shall be placed to eliminate interference with ducts, piping, and equipment. Exact locations shall be determined in the field. Door swings shall be verified to ensure that light switches are properly located.

Equipment sizes indicated are minimum. Before installing any wire or conduit, the Contractor shall obtain the exact equipment requirements and shall install wire, conduit, disconnect switches, motor starters, heaters, circuit breakers, and other items of the correct size for the equipment actually installed. Wire and conduit sizes shown on the drawings shall be taken as a minimum and shall not be reduced without written approval.

#### 1.4 CODES AND STANDARDS

Equipment design, fabrication, testing, performance, and installation shall, unless shown or specified otherwise, comply with the applicable requirements of NFPA 70 and IEEE C2 to the extent indicated by the references.

#### 1.5 COORDINATION

Installation of the electrical work shall be coordinated with the work of other trades.

#### 1.6 APPROVAL REQUIREMENTS

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories (UL), Inc., the label of, or listing with re-examination, in UL Elec Const Dir will be acceptable as sufficient evidence that the items conform to the requirements.

Where materials or equipment are specified to be constructed or tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized standards, a manufacturer's certificate of compliance indicating complete compliance of each item with the applicable NEMA, ANSI, ASTM, or other commercial standards specified will be acceptable as proof of compliance.

#### 1.7 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given a rust-inhibiting treatment and the standard finish by the manufacturer when used for most indoor installations. Aluminum shall not be used in contact with earth or concrete. Dissimilar metals in intimate contact shall be protected by approved fittings, barrier material, and treatment. Ferrous metals such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123/A 123M for exterior locations and cadmium-plated in conformance with FS A-A-59214 for interior locations.

#### 1.8 HAZARDOUS AREA

Electrical work within any hazardous location shall meet the applicable requirements of NFPA 70, Chapter 5, Articles 500 through 517. The

following definitions apply:

Explosionproof: A receptacle, fixture, device, or equipment enclosure that is designed to withstand explosion of a specified liquid, gas, vapor, or dust within the enclosure and to prevent the ignition of a specified gas, vapor, or dust surrounding the enclosure by sparks, flashes, or explosions of the specified liquid, gas, vapor, or dust that may occur within the enclosure. Enclosure shall be capable of operating at an external temperature that will not ignite a surrounding flammable atmosphere.

Hazardous location: An area where ignitable vapors or dust may cause a fire or explosion created by energy emitted from lighting or other electrical equipment or by electrostatic generation.

NFPA 70, Article 500-2 lists chemical atmospheres by groups A, B, C, and D. In addition, although not defined as a hazardous material by the NEC, oxygen concentrations (liquid and gaseous) are considered to provide a hazard because of the increased flammability of materials exposed to oxygen. Therefore, oxygen concentrations shall be classified under Group D.

## PART 2 PRODUCTS

### 2.1 IDENTIFICATION PLATES

Identification plates shall be 3-layer white-black-white, engraved to show black letters on a white background. Letters shall be uppercase. Identification plates 1-1/2 inches high and smaller shall be 1/16-inch thick with engraved lettering 1/8-inch high. Identification plates larger than 1-1/2 inches high shall be 1/8-inch thick with engraved lettering not less than 3/16-inch high. Identification plates having edges of 1-1/2 inches high and larger shall be beveled.

### 2.2 WARNING SIGNS

Each item of electrical equipment operating at 480 volts and above shall be provided with conspicuously located warning signs conforming to the requirements of Occupational Safety and Health Agency (OSHA) standards.

Any equipment with externally powered wiring shall be marked with a laminated plastic nameplate having 3/16-inch high white letters on a red background as follows:

DANGER - EXTERNAL VOLTAGE SOURCE

Safety color coding for identification of warning signs shall conform to ANSI Z535.1.

### 2.3 ANCHOR BOLTS

Anchor bolts shall be provided for equipment placed on concrete equipment pads or slabs.

### 2.4 SEISMIC ANCHORAGE

Electrical equipment, except communications, emergency, and standby equipment, shall be anchored to withstand a lateral force of 0.3 times the weight of the equipment.

Communications, emergency, and standby equipment shall be anchored to withstand a lateral force of 0.6 times the weight of the equipment.

The following standard anchoring should be adequate for equipment not classified as communications, emergency, or standby:

Dry transformers - floor-mounted with four anchor bolts

BOLT DIAMETER

Under 150 kVA	-	3/8
150 to 500 kVA	-	1/2
Over 500 kVA	-	5/8

Panels - floor-mounted with four 1/2-inch diameter anchor bolts

## 2.5 PAINTING

Enclosures of the following listed items shall be cleaned, primed, and factory-painted inside and outside in accordance with MS MIL-T-704.

ITEM	FINISH COLOR
Circuit Breakers	ANSI No. 61 gray
Substations	ANSI No. 61 gray
Switchgear	ANSI No. 61 gray
Transformers	ANSI No. 61 gray
Safety Switches	Manufacturer's standard
Panelboards	Manufacturer's standard
Electric Heaters	Manufacturer's standard
Motors	Manufacturer's standard
Limit Switches	Manufacturer's standard
Control Components	Manufacturer's standard

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors. Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations.

### 3.2 IDENTIFICATION PLATE INSTALLATION

Identification plates shall be fastened by means of corrosion-resistant steel or nonferrous metal screws. Hand lettering, marking, or embossed self-adhesive tapes are not acceptable.

### 3.3 EQUIPMENT PADS

Equipment pads shall be constructed with a minimum 4-inch margin around the equipment and supports.

### 3.4 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching on the building structure.

Holes in or through existing masonry walls and floors in exposed locations shall be drilled and smoothed by sanding. Use of a jackhammer will be permitted only where specifically approved.

### 3.5 DAMAGE TO WORK

Required repairs and replacement of damaged work shall be done as directed by and subject to the approval of the Contracting Officer, and at no additional cost to the Government.

### 3.6 CLEANING

Exposed surfaces of wireways, conduit systems, and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared for final finish or painting or are enclosed within the building structure.

Before final acceptance, electrical equipment, including lighting fixtures and glass, shall be clean and free from dirt, grease, and fingermarks.

### 3.7 FIELD TESTING AND TEST EQUIPMENT

All Field testing specified in Divisions 16 electrical specification shall be made with test equipment specially designed and calibrated for the purpose. Test equipment used shall be calibrated and certified by an approved testing laboratory. Date of last calibration and certification shall not be more than 90 days old at the time of field testing.

-- End of Section --

## SECTION 16286

## OVERCURRENT PROTECTIVE DEVICES

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C12.1 (2001) Electric Meters Code for  
Electricity Metering
- ANSI C37.09 (1979) IEEE Standard Test Procedure for AC  
High-Voltage Circuit Breakers Rated on  
Symmetrical Current Basis.
- ANSI C37.17 (1997) Trip Devices for AC and  
General-Purpose DC Low-Voltage Power  
Circuit Breakers
- ANSI C39.1 (1981; R 1992) Electrical Analog  
Indicating Instruments
- ANSI C63.2 (1996) Standard for Instrumentation -  
Electromagnetic Noise and Field Strength,  
10 kHz to 40 GHz - Specifications
- ANSI C63.4 (2004) Methods of Measurement of Radio -  
Noise Emissions from Low-Voltage  
Electrical and Electronic Equipment in the  
Range of 9 kHz to 40 GHz
- ANSI C78.23 (1995) Electric Lamps - Incandescent  
Lamps-Miscellaneous Types

## ELECTRONIC INDUSTRIES ALLIANCE (EIA)

- EIA 443 (1985) Solid State Relays, EIA/NARM,  
Standard for

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C37.90 (1994) Standard for Relays and Relay  
Systems Associated With Electric Power  
Apparatus
- IEEE C57.13 (1993) Standard Requirements for  
Instrument Transformers

## IPI - ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES (IPC)

- IPC D330 (1992) Switches

## JOINT INDUSTRIAL COUNCIL (JIC)

JIC-01 (1967) Electrical Standards for Mass  
Production Equipment

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 107 (1987; R 1993) Methods of Measurement of  
Radio Influence Voltage (RIV) of  
High-Voltage Apparatus

NEMA 250 (2003) Enclosures for Electric Equipment  
(1000 Volts Maximum)

NEMA AB 1 (2002) Molded Case Circuit Breakers,  
Molded Case Switches, and Circuit-Breaker  
Enclosures

NEMA AB 3 (2001) Molded Case Circuit Breakers and  
Their Application

NEMA FU 1 (2002) Low Voltage Cartridge Fuses

NEMA ICS 1 (2000) Industrial Control and Systems:  
General Requirements

NEMA ICS 2 (2000) Industrial Controls and Systems  
Controllers, Contactors, and Overload  
Relays Rated Not More Than 2,000 Volts AC  
or 750 Volts DC

NEMA ICS 3 (1993; R 2000) Industrial Control and  
Systems Factory Built Assemblies

NEMA SG 5 (1995) Power Switchgear Assemblies

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 1066 (1997) Low-Voltage AC and DC Power Circuit  
Breakers Used in Enclosures

UL 20 (2000; Rev thru June 2003) General-Use  
Snap Switches

UL 489 (2002; Rev thru May 2003) Molded-Case  
Circuit Breakers, Molded-Case Switches,  
and Circuit-Breaker Enclosures

## 1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330,  
"Submittals," in sufficient detail to show full compliance with the  
specification:

SD-01 Preconstruction Submittals

No change in continuous-current rating, interrupting rating, and clearing or melting time of fuses shall be made unless written permission has first been secured from the Contracting Officer.

#### SD-02 Shop Drawings

Connection Diagrams and Fabrication Drawings shall be submitted for the following items in accordance with paragraph entitled, "General Requirements," of this section.

Installation drawings shall also be submitted for the following items in accordance with the paragraph entitled, "Installation," of this section.

Control Devices  
Protective Devices

#### SD-03 Product Data

Equipment and performance data shall be submitted for the following items including use life, system functional flows, safety features, and mechanical automated details.

Manufacturer's catalog data shall also be submitted for the following items:

Instrument Transformers  
Enclosures  
Circuit Breakers  
Control Devices  
Protective Relays  
Indicating Instruments  
Indicating Lights

#### SD-06 Test Reports

Factory Test Reports shall be submitted for Power, High Voltage, and Oil Circuit Breakers in accordance with ANSI C37.09.

Timing Test

#### SD-07 Certificates

Certificates shall be submitted for Circuit Tests on similar motor-control or motor-circuit protector (MCP) units under actual conditions may be submitted in lieu of factory tests on the actual units provided.

#### SD-08 Manufacturer's Instructions

Manufacturer's Instructions shall be submitted for the following items, including special provisions required to install equipment components and system packages. Special notices shall detail, resistance impedances, hazards and safety precautions.

Control Devices  
Protective Devices

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted for the following equipment:

- Circuit Breakers
- Protective Relays
- Indicating Instruments

1.3 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

Connection Diagrams shall be submitted showing the relations and connections of control devices and protective devices by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Fabrication Drawings shall be submitted for control devices and protective devices consisting of fabrication and assembly details to be performed in the factory.

PART 2 PRODUCTS

2.1 INSTRUMENT TRANSFORMERS

Instrument transformers shall comply with the interference requirements listed below, measured in accordance with ANSI C63.2, ANSI C63.4, and NEMA 107.

Insulation Class, kV	Basic Insulation Level, kV	Preferred Nominal System Voltage, kV	Test Voltage for Potential Transformers, kV	Test Voltage for Current Transformers, kV	Radio Influence Voltage Level, Microvolts	
					Dry Type	Oil Filled
0.6	10	.....	.....	0.76	250	250

2.1.1 Current Transformers

Current transformers shall conform to IEEE C57.13 for installation in metal-clad switchgear. Standard 3-A secondary transformer shall be used.

Transformers shall be window type.

Transformers shall be complete with secondary short-circuiting device.

Window-type current transformers shall be indoor dry type construction with secondary current ratings as indicated. Burden, frequency, and accuracy shall be as specified.

2.1.2 Potential Transformers

Potential transformers shall conform to IEEE C57.13 for installation in metal-clad switchgear. Standard 120-volt secondary transformers shall be

used.

Burden, frequency, and accuracy shall be as required.

Disconnecting potential transformers with integral fuse mountings and current-limiting fuses shall be indoor dry type two-winding construction with primary and secondary voltage ratings as required.

## 2.2 ENCLOSURES

### 2.2.1 Equipment Enclosures

Enclosures for equipment shall be in accordance with NEMA 250.

Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures.

## 2.3 CIRCUIT BREAKERS

Circuit breakers shall conform to UL 489, NEMA AB 1, and NEMA AB 3.

### 2.3.1 Molded-Case Circuit Breakers

Circuit breakers shall be molded case, manually operated, trip-free, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.

Thermal-magnetic tripping elements shall be located in each pole of the circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. Instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker on frame sizes larger than 100 amperes.

Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.

Interrupting capacity of the panel and lighting branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker interrupting capacities shall be a minimum of 10,000 amperes and shall conform to NEMA AB 3.

Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 104 degrees F. Circuit breakers shall have root mean square (rms) symmetrical interrupting ratings sufficient to protect the circuit being supplied. Interrupting ratings may have selective type tripping (time delay, magnetic, thermal, or ground fault).

Breaker body shall be of phenolic composition. Breakers shall be capable of having such accessories as handle-extension, handle-locking, and padlocking devices attached where required.

Circuit breakers used for motor-circuit disconnects shall meet the applicable requirements of NFPA 70 and shall be of the motor-circuit protector type.

Circuit breakers used for service disconnection shall be the enclosed circuit-breaker type with external handle for manual operation. Enclosures shall be sheet metal with a hinged cover suitable for surface mounting.

### 2.3.2 Low Voltage Power Circuit Breakers

Circuit breakers shall comply with the requirements of IEEE/ANSI C37.13/16/1 7/50, UL 1066, NEMA SG 3. All breakers shall be three-pole, 100 percent rated and shall be manufactured by Siemens Energy & Automation, type WL Power Circuit Breaker or approved equal.

Circuit breaker element shall have Connected, Test, and Disconnected position indicators, Spring Charged/Discharged indicators, and circuit breaker Open or Closed and Ready-to-Close indicators all of which shall be visible to the operator with the compartment door closed. It shall be possible to rack the circuit breaker element from the connected to the disconnected position with the compartment door closed {otherwise known as through the door Drawout}.

Provide interlocks to prevent racking the circuit breaker unless the breaker is open.

Ratings: Interrupting up to 150 kA at 480V without fuses. Short time current ratings for each circuit breaker shall be as indicated on the drawings or data tables. Circuit breakers shall be 600-volt class.

Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:

1. Normal Closing Speed: independent of both control and operator.
2. Electrical operator, field installable with manual charging.
3. Operation counter.

Each low voltage power circuit breaker shall be equipped with self-powered, microprocessor-based trip-device to sense overload and short circuit conditions. The device shall measure true RMS current. The tripping system shall consist of Rogowski coils {sensors} on each phase, a release mechanism, and the following features:

1. Field Installable and Interchangeable so that any trip unit can be used with any frame size circuit breaker and can be upgraded for future expansion in functionality, such as communication.
2. Functions: Long time, short time and extended instantaneous protection function shall be provided {EIP} to allow the breaker to be applied at the withstand rating of the breaker with minus 0 percent tolerance so that there is no instantaneous override whatsoever. This feature shall furthermore allow the circuit breaker to be applied up to the full instantaneous rating of the breaker on systems where the available fault current exceeds the breakers withstand rating. Each shall have an adjustable pick-up setting. In addition, long time and short time bands shall each have adjustable time delay. Short time function shall include a switchable I<sup>2</sup>t ramp and optionally I<sup>4</sup>t to improve coordination with fuses or inverse relays.
3. A software program shall be made available free of charge to support system coordination. The software will allow time current curves to be generated for the chosen settings.
4. Individual LED's shall indicate an overcurrent, short circuit or ground fault trip condition. The data shall be maintained for a

- minimum of 48 hours without the need for a separate battery.
5. Time-current characteristics shall be field adjustable.
  6. Current Adjustability: Dial settings and rating plugs on trip units.
  7. Pickup Points: 10 Long Time Settings.
  8. Field Installable Ground-fault protection with at least three time-delay bands; adjustable current pickup and an I<sup>2</sup>t ramp. Arrange to provide protection for four-wire service.
  9. Field installable zone selective interlocking: Connections will be made between main, tie and feeder circuit breakers to ensure that the circuit breaker closest to the fault trips for short time and ground fault conditions.
  10. Field Installable Communications Profibus and metering functions shall be provided per schedule.
  11. A LCD display shall be available to simplify settings and viewing data locally.
  12. The option to remotely switch protection settings shall be provided whenever a generator is part of the power distribution system or load shedding is required.
  13. Field installable configurable output relays shall be available to connect directly to the trip unit via a internal cubical bus.
  14. Waveform display option on LCD display.

MOC {mechanism operated cell switch} operated by the circuit breaker operating mechanism.

Terminal Block Connections, shall be front mounted and available in either Screw Type Terminal or Ring Tongue Terminal.

Padlocking Provisions: For installing at least three padlocks on each circuit breaker to prevent movement of the drawout mechanism.

Operating Handle: shall be built in complete with handle and integral to breaker. No external tools shall be required to rack the breaker.

Control Switch: One for each electrically operated circuit breaker.

Key Interlocks: Mountings and hardware are included where future installation of key-interlock devices is indicated.

Undervoltage Trip must be field installable: Adjustable time-delay.

Shunt-Trip must be field installable.

Fused Circuit Breakers: Circuit breaker and fuse combinations must comply with requirements for circuit breakers and trip devices and include the following:

1. Fuses: NEMA FU 1, Class J or L current limiting, sized to coordinate with and protect associated circuit breaker.
2. Blown-Fuse Trip Device: fused circuit breakers are to be equipped with blown fuse lockout devices to prevent closing the breaker if a fuse is blown or not present. Open-fuse status is indicated at the front of the circuit breaker or fuse drawout element.

#### 2.3.2.1 Production Testing

Perform production tests in compliance with ANSI C37 and NEMA SG 5 requirements.

### 2.3.2.2 Accessories

Modular communication and relaying accessories are to be available for retrofitting by the client's chosen engineer. It shall not be necessary for the manufacturers personnel to retro fit accessories

Portable lifting yoke for circuit breakers.

Hand held portable test set for testing trip unit and CT 's without removal from switchgear.

The following items must be capable of being changed in the field: main contacts, CT's, trip units, racking mechanism, all internal and external accessories.

## 2.4 CONTROL DEVICES

### 2.4.1 Pushbuttons and Switches

#### 2.4.1.1 Ammeter Selector Switches

Ammeter selector switches for switchgear shall be rotary multistage snap-action type in accordance with UL 20 with silver-plated contacts rated for 600 volts ac or dc. Selector switch shall be a manually operated, four-position device rated for 600 volts, 20 amperes, minimum, and designed to permit current readings on each bus of the main bus from a single indicating instrument. Ammeter switch shall be mounted on the hinged front panel of the switchgear compartment and shall be completely isolated from high-voltage circuits, with engraved escutcheon plate.

Selector switch handle shall be pistol-grip type.

#### 2.4.1.2 Voltmeter Selector Switches

Voltmeter selector switches for switchgear shall be rotary snap-action type in accordance with UL 20 with silver-plated contacts rated for 600 volts ac or dc. Switch shall be a manually operated, four-position device designed to permit voltage readings on each phase of the main bus from a single indicating instrument. Voltmeter switch shall be mounted on the hinged front panel of the switchgear compartment and shall be completely isolated from high-voltage circuits, and with engraved escutcheon plate.

Selector switch handle shall be pistol-grip type.

#### 2.4.1.3 Miscellaneous Switches

Float, limit, door, pressure, proximity, and other types of switches shall be in accordance with IPC D330 and of the types and classes indicated.

## 2.5 PROTECTIVE RELAYS

### 2.5.1 Overcurrent Relays

Overcurrent relays shall conform to IEEE C37.90.

Overcurrent relays for protection against phase and ground faults shall be single-phase nondirectional removable induction type with built-in testing facilities. Relays shall be designed for operation on the dc or ac control circuit indicated.

Ground-fault overcurrent relays shall have short-time inverse time characteristics with adjustable current tap range as required.

Phase-fault overcurrent relays shall have varied inverse-time characteristics with adjustable current tap range as required and indicating instantaneous-trip attachments with adjustable current range as required.

Case shall be semiflush-mounted to the hinged instrument panel and shall have matching cover.

Solid-state static-type trips for low-voltage power circuit breakers shall be in accordance with EIA 443 and ANSI C37.17.

Trip unit shall employ a combination of discreet components and integrated circuits to provide the time-current protection functions required in a modern selectively coordinated distribution system.

Complete system selective coordination shall be provided by utilizing a combination of the following time-current curve-shaping adjustments: ampere setting; long-time delay; short-time pickup; short-time delay; instantaneous pickup; and ground fault.

Instantaneous and ground fault trips shall be switchable or easily defeatable.

All adjustments shall be made using non-removable, discrete step, highly reliable switching plugs for precise settings. A sealable, transparent cover shall be provided over the adjustments to prevent tampering.

Trip devices shall be furnished with three visual indicators to denote the automatic tripping mode of the breaker including: overload; short circuit; and ground fault.

Trip unit shall be wired to appropriate terminals whereby an optional remote automatic trip accessory can be utilized to provide the same indication.

A series of optional automatic trip relays shall be available for use with the trip unit to provide remote alarm and lockout circuits.

All trip units shall be provided with test jacks for in-service functional testing of the long-time instantaneous and ground fault circuits using a small hand-held test kit.

#### 2.5.2 Directional Overcurrent Relays

Directional overcurrent relays shall be in accordance with IEEE C37.90.

Directional overcurrent relays for protection against reverse-power faults shall be single-phase induction type with adjustable time-delay and instantaneous trip attachments. Relays shall be removable type with inverse-time directional and overcurrent units with built-in testing facilities.

Case shall be semiflush-mounted to the hinged instrument panel and shall have matching cover.

### 2.5.3 Reclosing Relays

Reclosing relays shall conform to IEEE C37.90.

Reclosing relays shall be designed to reclose circuit breakers that have tripped from overcurrent. This device shall automatically reclose the breaker at adjustable time intervals between reclosures and then lock out the breaker in the open position if the fault persists. If the fault disappears after any reclosure, the circuit breaker shall remain closed and the reclosing relay shall reset automatically and be ready to start a new sequence of operation.

Reclosing relays shall be removable with built-in testing facilities and shall consist of a timing unit rated at 120/240 volts, single-phase, ac and solenoid and contactor units with dc rating as indicated. Contacts shall be arranged for one instantaneous reclosure and two subsequent reclosures at 15 and 45 seconds, respectively. Time dial shall be set for 60-second drum speed.

Case shall be semiflush-mounted to the hinged instrument panel and shall have a matching cover.

### 2.5.4 Undervoltage Relays

Undervoltage relays shall conform to IEEE C37.90.

Undervoltage relays shall be three-phase induction type inverse timing with adjustable high- and low-voltage contacts and calibrated scale for protection against loss of voltage, undervoltage, and overvoltage. Relays shall be equipped with indicating contactor and voltage switches to provide electrically separate contact circuits. Relays shall be removable type with built-in testing facilities and shall be suitable for operation on 120-volt ac circuits. Contacts shall be suitable for operation on dc or ac control circuits.

Case shall be semiflush-mounted to the hinged instrument panel and shall have a matching cover.

## 2.6 INDICATING INSTRUMENTS

### 2.6.1 Ammeters

Ammeters shall conform to ANSI C39.1.

Switchboard indicating ammeters shall be approximately 4-1/2 inches square with 250-degree scale and recessed cases suitable for flush mounting. Dials shall be white with black figures and black pointers. Instruments shall be mounted on the hinged front panel of the switchgear compartment and shall be completely isolated from high-voltage circuits. Meters shall be standard 5-ampere type for a zero to full-scale normal movement, 60 hertz.

### 2.6.2 Voltmeters

Voltmeters shall conform to ANSI C39.1.

Switchboard indicating voltmeters shall be approximately 4-1/2-inches square with 250-degree scale and recessed cases suitable for flush mounting. Dials shall be white with black figures and black pointers.

Instruments shall be mounted on the hinged front panel of the switchgear compartment and shall be completely isolated from high-voltage circuits. Voltmeters shall be standard 120-volt type for a zero to full-scale normal movement, 60 hertz.

### 2.6.3 watt-Hour Meters/wattmeters

Watt-hour meters, wattmeters, and pulse initiation meters shall conform to ANSI C12.1.

Switchboard wattmeters for use with instrument transformers shall be three-phase induction type with two stators, each equipped with a current and potential coil. Meter shall be rated 5 amperes at 120 volts and shall be suitable for connection to three-phase, 3- and 4-wire circuits. Instrument shall be complete with potential indicating lamps, light-load and full-load adjustments, phase balance, power-factor adjustments, four-dial clock register, ratchets to prevent reverse rotation, and built-in testing facilities.

Pulse initiating meters for use with demand meters or pulse recorders shall be suitable for use with mechanical or electrical pulse initiators. Mechanical load imposed on the meter by the pulse initiator shall be within the limits of the pulse meter. Load shall be as constant as practical throughout the entire cycle of operation to ensure accurate meter readings.

Pulse initiating meter shall be capable of measuring the maximum number of pulses at which the pulse device is nominally rated. Pulse initiating meter may be considered to be operating properly when a kilowatthour check indicates that the demand meter kilowatthours are within limits of the wathour meter kilowatthours.

Pulse initiating meters shall be located such that components sensitive to moisture and temperature conditions are minimized. Precautions shall be taken to protect sensitive electronic metering circuitry from electromagnetic and electrostatic induction.

Meters shall be removable and shall be furnished with draw out test plug. Contact devices shall be furnished to operate remote impulse-totalizing graphic demand meters.

Case shall be semiflush-mounted to the hinged instrument panel and shall have a matching cover.

## 2.7 FACTORY TESTING

Factory tests on control and low voltage protective devices shall be performed in accordance with the manufacturer's recommendations.

Short-circuit tests shall be in accordance with Section 2 of NEMA ICS 1.

Factory tests on power, high-voltage, and oil circuit breakers shall be in accordance with ANSI C37.09.

## 2.8 INDICATING LIGHTS

### 2.8.1 General-Purpose Type

Indicating lights shall be oiltight instrument devices with threaded base and collar for flush-mounting, translucent convex lens, candelabra screw-base lampholder, and 120-volt, 6-watt, Type S-6 incandescent lamp in

accordance with ANSI C78.23. Color code for indicating lights shall be in accordance with JIC-01.

Indicating lights shall be provided in remote-control stations when pushbuttons and selector switches are out of sight of the controller.

### 2.8.2 Switchboard Indicating Lights

Switchboard indicating lights shall be the manufacturer's standard transformer type units 120-volt input utilizing low-voltage lamps and convex lenses of the colors indicated. Indicating lights shall be capable of being relamped from the switchboard front. Indicating lights utilizing resistors in series with the lamps are not permitted except in direct-current control circuits. Lights shall have a press-to-test feature.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Control devices and protective devices not factory installed in equipment shall be installed in accordance with the manufacturer's recommendations and shall be field adjusted and operation tested. Installations shall conform to NFPA 70, NEMA ICS 1, NEMA ICS 2, and NEMA ICS 3 requirements for installation of control and protective devices.

### 3.2 FIELD TESTING

Control and protective devices not factory installed in equipment shall be demonstrated to operate as indicated.

Instrumentation, potential, and current transformers shall be ratio'd and tap settings verified.

Circuit breakers rated 15KV and above shall be given a timing test to verify proper contact speed, travel, bounce, and wipe.

Control and protective devices shall not be energized until recorded test data have been approved by the Contracting Officer. Final test reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

-- End of Section --

## SECTION 16366

## SECONDARY UNIT SUBSTATION

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

## ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M (2003) Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM D 3487 (2000) Mineral Insulating Oil Used in Electrical Apparatus

ASTM D 3612 (2001) Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography

## INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

IEEE C37.20.1 (2002) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear

IEEE C37.20.2 (1993) Metal-Clad and Station-Type Cubicle Switchgear

IEEE C57.12.00 (2000) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

IEEE C57.12.90 (1999) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers

IEEE Std 4 (1995) Standard Techniques for High Voltage Testing

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA SG 5 (1995) Power Switchgear Assemblies

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

## U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD 595 (Rev B) Colors Used in Government

## Procurement

## UNDERWRITERS LABORATORIES (UL)

UL 1062	(1997; Rev thru Aug 2001) Unit Substations
UL 467	(1993; Rev thru Feb 2001) Grounding and Bonding Equipment

## 1.2 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

Certificates shall be submitted for secondary unit substations including the following:

Certified evidence of the qualifications of the system coordination specialist shall be submitted.

In lieu of factory tests on actual units furnished certified copies of previous tests on similar units under actual conditions, not simulated, shall be submitted for impulse tests, temperature rise tests, sound tests, bushing tests, and short circuit tests.

Manufacturer's Standard Color Charts shall be submitted for secondary unit substations showing the manufacturer's recommended color and finish selections.

## 1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

## SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists shall be submitted for Secondary Unit Substations including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

## SD-02 Shop Drawings

Connection diagrams shall be submitted indicating the relations and connections of the following items by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Outgoing Section  
Switchgear Components

Fabrication drawings shall be submitted for the following items consisting of fabrication and assembly details to be performed in the factory.

Outgoing Section  
Switchgear Components

#### Accessories

Installation Drawings shall be submitted for the Secondary Unit Substation in accordance with the paragraph entitled, "Installation," of this section.

#### SD-03 Product Data

Equipment and performance data shall be submitted for the following items including life, test, system functional flows, safety features, and mechanical automated details.

Outgoing Section  
Switchgear Components

Manufacturer's catalog data shall be submitted for the following items:

Outgoing Section  
Switchgear Components  
Weatherproof Enclosures

#### SD-04 Samples

Manufacturer's Standard Color Charts shall be submitted for secondary unit substations in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-06 Test Reports

Test Reports shall be submitted for the following tests on secondary unit substations in accordance with the paragraphs entitled, "Factory Testing," "Field Testing" and "Relay Settings and Tests," of this section.

Electrical Acceptance Tests  
Insulation Resistance Test  
Ratio and Polarity Tests

#### SD-07 Certificates

Listing of Product Installations for secondary unit substations shall be submitted in accordance with paragraph entitled, "Installation," of this section.

Certificates shall be submitted for secondary unit substations in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for the Secondary Unit Substation including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

#### SD-10 Operation and Maintenance Data

Operation and maintenance manuals shall be submitted for the

following equipment:

Switchgear Assemblies  
Transfer Switches  
Space Heaters

#### 1.4 QUALIFICATIONS FOR MANUFACTURERS

Material and equipment to be provided under this specification shall be the standard catalog product of a manufacturer regularly engaged in the manufacture of secondary unit substations and their component parts and equipment. Equipment shall be of the latest standard design for indoor or outdoor service and shall have been in repetitive manufacture for at least 150 units. Tests on transformers shall be conducted in accordance with IEEE C57.12.90, ASTM D 3612 and ASTM D 3487 (for oil filled). Manufacturer shall certify that insulating oil contains no PCB's and shall affix a label to that effect on the transformer tank and on each oil drum containing the insulating oil. No transformer shall be shipped to site until all factory tests and their results are approved by the Contracting Officer and the equipment is inspected and approved by the Contracting Officer unless he has given the manufacturer a written waiver.

#### 1.5 SYSTEM COORDINATION AND TESTING SERVICES

System coordination studies, relay settings, and tests shall be performed by a professional electrical engineer who can present evidence of at least 5 years experience in system coordination and tests of the kind herein specified in not less than five projects of comparable size and complexity.

Work shall be done by or under the direct supervision of this specialist. Personnel working pursuant to this section, may at the Contracting Officer's option, be required to demonstrate technical competence by performing sample work and/or by displaying their state qualifications/certificates, at no additional cost to the Government.

#### 1.6 DELIVERY, HANDLING, AND STORAGE

Subassemblies of secondary-unit substations shall be delivered, stored, handled, and installed in a manner that will not damage the equipment. Equipment shall be stored indoors in the original unbroken protective covering and shipping container, in a clean, dry, and ventilated location.

During installation, equipment shall be protected from the weather.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT STANDARDS

Secondary unit substations shall conform to UL 1062.

#### 2.2 ELECTRICAL CHARACTERISTICS

##### 2.2.1 Ratings

Outgoing section is rated 600-volts, three-phase, four-wire, 60-hertz, for grounded power-distribution systems.

#### 2.3 METAL-ENCLOSED BUS, SECONDARY TRANSITION SECTION

Metal-enclosed bus shall be nonsegregated group phase construction and

shall include rigid insulated conductors and supports in a grounded metal enclosure with associated ventilation and space-heater enclosures, condensation barriers, expansion and connection joints, and fittings in accordance with IEEE C37.20.1.

Enclosures shall be completely bused with an insulated solid rigid copper bus bar. Bus bar and connections shall be uniformly positioned and phase sequenced within the enclosure for adaptation to metal-clad switchgear assemblies and power transformers, in accordance with IEEE C37.20.1.

Front breaker doors and covers must be free of any ventilation openings.

Main bus shall connect vertical sections and shall be uniform capacity the entire length of assembly. Vertical and horizontal bus bar shall utilize a channel shape design to maximize short circuit withstand capability and minimize heat rise. The main horizontal bus shall be run in a vertical, edge-to-edge arrangement for high short circuit strength. Access to the rear cable termination area shall be possible without reaching over the main and vertical bus. Bus bracing shall be equal to the short circuit interrupting rating of the lowest rated circuit breaker applied in the assembly or 100kA minimum.

Bus bar shall be supported and braced to withstand short-circuit stresses with momentary current ratings, in accordance with IEEE C37.20.1. Contact surfaces of all bus connections shall be silverplated and bolted together to ensure maximum conductivity. Voltage and current ratings shall conform to IEEE C37.20.1.

Insulating supports shall consist of track-resistant, flame-retardant IEEE Class 130 electrical insulating materials. Voltage rating and insulation level shall conform to IEEE C37.20.1.

Sheetmetal weatherproof enclosures shall be constructed from carbon steel sheets of commercial quality, not less than 14 gage. Each section shall be reinforced with structural members and bolted together. Complete assembly shall be structurally supported as indicated.

Temperature limits for a metal-enclosed bus shall conform to IEEE C37.20.1.

## 2.4 OUTGOING SECTION

### 2.4.1 Switchgear and Auxiliary Equipment Compartments

Switchgear and auxiliary equipment of the outgoing section shall be a metal-enclosed, low-voltage power circuit switchgear assembly in a self-contained self-supporting unit with sheet metal compartments joined together to form a continuous structure.

Unit sheet metal housing shall enclose one or more vertically mounted power circuit breakers or auxiliary equipment in individual sheet metal compartments and a full height rear compartment. Housing shall be approximately 90 inches high with individual front-hinged panels and hinged top and hinged rear covers. Rear compartment shall contain the main bus, main bus tap connections, cable connections, and instrument transformers.

Barriers between a sectionalized bus with bus sectionalizing breakers in a compartment shall be sheet steel not less than 11 gage. Other covers, barriers, panels, and doors shall be not less than 14 gage.

Sheet metal barriers and enclosures shall be constructed from cold-rolled carbon-steel sheets of commercial quality with stretcher-level flatness conforming to ASTM A 1008/A 1008M. Each compartment shall be reinforced with structural members and welded together. Welds shall be ground to a smooth flat surface before painting.

Circuit breaker compartments are to be barriered from the bus compartment through a primary disconnect assembly.

Circuit breaker compartments shall include stationary primary contact disconnects that shall be silver-plated copper at the connection points and of one-piece construction.

1. The upper set of disconnects shall bolt directly to the main bus and, for feeder circuit breakers, the lower set shall extend to the rear cable area and shall be insulated where they pass through the main bus compartment.
2. Primary disconnects shall be sized for the maximum continuous current for the frame size of the circuit breaker which is located in the compartment.
3. Interlocks shall be provided to prevent a circuit breaker element of the incorrect frame size or interrupting rating from being inserted into the compartment.
4. Secondary control and communication connections, when required, shall be located in a separately accessed area that is accessible from the front of the switchgear without opening the breaker compartment door or exposing any power cables or bussing. The secondary control contacts shall be of the sliding contact design, silver plated and engage the drawout circuit breaker element in the "connected" and "test" positions.

Removable elements of the same type and rating in the switchgear assembly shall be physically and electrically interchangeable in corresponding compartments.

Front-hinged panel shall be suitable for mounting instruments, relays, control switches, and indicating lamps.

Compartments shall be completely bused with bare rigid copper solid busbar. Main buses and bus-tap connections shall be uniformly positioned and phase sequenced in accordance with IEEE C37.20.1.

Buses shall be supported and braced to withstand the maximum short-circuit stresses that would be incurred under the most severe fault conditions. Contact surfaces of all main bus and tap connections shall be silver plated and bolted together to ensure maximum conductivity.

Main bus shall be readily accessible for connection of future switchgear assemblies at either end.

Voltage rating and insulation level of switchgear assemblies shall conform to IEEE C37.20.1.

Temperature limits for buses and bus-tap connections in switchgear assemblies shall be in accordance with IEEE C37.20.1.

A continuous rigid copper ground bus shall extend throughout the entire outgoing-line section and shall ground the stationary structure and equipment. Ground bus shall be capable of carrying the maximum rated short-circuit current of the protective device in the switchgear assembly

for a minimum period of 1.0 second.

Low-voltage wiring for controls and accessories shall be run to terminal blocks having numbered points, as indicated, to identify all circuits. All low-voltage wiring shall be run in conduit, raceways, or wiring troughs to isolate the wiring from high-voltage circuits.

Each compartment of the switchgear assembly shall be identified with the manufacturer's standard identification plate engraved with circuit and function designations. Compartments shall be completely wired with cable terminals, cable clamps, control bus, control power switch, and terminal blocks. Terminal blocks shall be readily accessible for the external connections of metal-clad switchgear.

#### 2.4.2 Switchgear Assemblies

General arrangement of the outgoing section, the number of compartments, and each compartment's components shall be as indicated.

Transformer secondary switchgear compartments shall include a metal-enclosed low-voltage power circuit breaker.

Bus sectionalizing switchgear compartments shall include the following components:

- Metal-enclosed low-voltage main power circuit breaker

Secondary feeder switchgear compartments shall include the following equipment:

- Metal-enclosed low-voltage main power circuit breaker

- Provisions for terminating cables

Auxiliary metering compartments shall include the following:

- Current transformers

- Ammeters and ammeter switches

- Control power transformer and primary fuses for 120 volt receptacle and lights

- Potential transformers

- Voltmeters and voltmeter switches

- watt transducers

- watt-hour meters

- Reverse current directional relays

#### REVENUE METERING

- a. All facilities shall be provided with a combination kWh/Demand meter on the secondary side of each distribution transformer.

- b. Metering shall consist of three bushing mounted current

transformers sized for 1500kVA load, kWh meter with 15-minute pulse interval, meter base and all interconnecting wiring.

- c. Provide conduit knockouts in the meter base for future connection of EMCS conduits and wiring.
- d. Electrical metering equipment (meter and instrument transformers) shall meet or exceed the 0.3 accuracy class for revenue metering.
- e. Meter shall contain output terminals for external kW and kWh monitoring connected to K, Y, and Z output terminals.
- f. Meter shall be 277-volt, 4-wire wye, 3 elements, Class 20, Form 9S, 13 Terminal, with pulse initiator, or equivalent.
- g. The meter shall have five (5) KWH dials with no decimal places (XXXXXX) and five (5) KW dials with two decimal places (XXX.XX). Both registers shall have the same multiplier and the multiplier shall be inscribed in pencil on the nameplate in the appropriate place. A copy of the programming sheet shall be included with installation. The meter shall be programmed and shall not be password protected.
- h. Current transformers shall be placed around low voltage bushings.
- i. Meter shall be mounted in a 20-amp, transformer rated, 13-terminal meter socket, ringless with 10-pole test switches.
- j. Meter socket shall be a Milbank Type S7449-XL or approved equal to facilitate changing the meter without interrupting the load.
- k. Test switches shall be Superior Switchboard and Devices Type MP713-FMS-2975, or approved equal.
- l. All installations are to include delivery of the appropriate software and optical probe to program the meter.

Auxiliary bus sectionalizing compartments shall include a contactor for automatic transfer of control power and auxiliary devices.

Switchgear compartments for future use shall be fully equipped to receive the removable element with complete bus connections, disconnecting devices, bus, and cell interlocks.

Filler compartments incidental to the switchgear assembly shall be empty compartments with bolted cover plates.

Main and feeder power circuit breakers shall be fully rated and arranged for selective trip systems in accordance with NEMA SG 5.

## 2.5 SWITCHGEAR COMPONENTS

All circuit breakers shall be quick close type.

### 2.5.1 Air Circuit Breakers

Air circuit breakers shall be solenoid-operated or stored-energy-operated types and shall conform to the applicable requirements of Section 16286, "Overcurrent Protective Devices."

### 2.5.2 Power Circuit Breakers

Power circuit breakers shall conform to the applicable requirements of Section 16286, "Overcurrent Protective Devices."

### 2.5.3 Molded-Case Circuit Breakers

Molded-case circuit breakers shall conform to the applicable requirements of Section 16286, "Overcurrent Protective Devices."

### 2.5.4 Ground-Fault Protection

Ground-fault trip circuits for 225-ampere frame-size breakers shall have selective pickup points at 100, 200, 300, and 400 amperes. Ground-fault trip circuits for 600- and 1,600-ampere frame size breakers shall have selective pickup points at 300, 600, 900, and 1,200 amperes. Ground-fault trip circuits for 3,000-ampere frame size breakers shall have selective pickup points at 750, 1,500, 2,250, and 3,000 amperes.

A calibrated faceplate with adjustable captive thumbscrews shall be provided for pickup-current settings, time-delay band settings, and ground-fault current and time settings. A single thumbscrew shall adjust all three phases of the tripping circuit for any particular time/current characteristic. Tripping circuits shall be independent of each other in action and adjustment.

### 2.5.5 Instruments and Instrument Transformers

Indicating instruments, protective relays, current and potential transformers, instrument transfer switches, control-power transformers, and the like shall conform to the applicable requirements of Section 16286, "Overcurrent Protective Devices."

### 2.5.6 Control-Power Circuit Overcurrent Protection

Branch-circuit breakers shall provide circuit overload protection to compartment heater, lights, convenience outlets, transformer fans, and other substation devices.

### 2.5.7 Service and Maintenance Devices

The following service and maintenance devices shall be included as a part of each building substation:

- A manual handle for operating the air and power circuit breaker isolating mechanism

- Removable manual maintenance closing devices for air and power circuit breakers

- Transfer trucks and hoists for air and power circuit breakers

- Facilities for operating air and power circuit breakers in the test or removed position

- Facilities for withdrawing air and power circuit breakers for inspection or maintenance

Secondary injection test set for testing of breaker solid state trip devices.

Test plugs and cable for meters and relays

#### 2.5.8 Protective Relays and Devices

Protective relays and devices shall comply with Section 16286, "Overcurrent Protective Devices."

#### 2.6 SPACE HEATERS

Each section of the secondary unit substation, including the primary switch, and the secondary switchgear assemblies, shall be equipped with space heaters to provide approximately 4 watts per square foot of outer surface area. Heaters shall be such that the power density does not exceed 4 watts per square inch of heater element surface. Heaters shall be rated at 240 volts for connection to 120 volts.

Heaters shall be located at the lowest portion of each space to be heated. Terminals shall be covered. Thermostats shall be used to regulate the temperature.

All heaters shall be installed and operable at the time of shipment so that the heaters can be operated immediately upon arrival at the site, during storage, or before installation. Connection locations shall be marked prominently on drawings and shipping covers and shall have temporary leads for storage operation. Leads shall be easily accessible without having to remove shipping protection.

#### 2.7 AUTOMATIC TRANSFER SWITCH OPERATION AND DEVICES

Provision shall be made for the automatic transfer of load on loss of voltage, low voltage, single phasing, reverse phase rotation of either source, and the automatic retransfer of load upon restoration of normal service without a service interruption. Under normal operation, both main secondary breakers will be closed with the main bus tie breaker open and the automatic/manual transfer control switch in the automatic position, and each source of supply will be energized and carrying load.

Main and bus tie breakers shall be electrically operated with remote pushbutton controls electrically interlocked so that only two of the three breakers may be closed by operation of the respective breaker-closing mechanisms when the automatic/manual transfer control switch is in the manual position.

Main secondary breaker compartments shall include undervoltage and phase-sequence relays with adjustable time-delay between 30 and 200 cycles.

Auxiliary relays shall automatically open the proper main secondary breaker and close the main bus tie breaker under fault conditions. Provisions shall be included for the automatic reclosing of the main secondary breakers before opening the main bus tie breaker when normal service is restored.

Lockout relays shall prevent automatic transfer of load from undervoltage caused by overload or transient conditions. Lockout relay controls shall be connected into the closing circuit of the main tie breaker to prevent operation under lockout conditions and shall be the hand-reset type.

Main bus tie breaker compartment shall include an automatic/manual transfer switch which shall disconnect the automatic transfer features when in the manual position. Main secondary and bus tie breakers shall be manually inoperable when the automatic/manual transfer control switch is in the automatic position.

A bypass switch shall be provided to permit manual momentary paralleling of the two sources of supply in restoring normal service without interruption.

Main secondary and bus tie breakers shall be manually operable when the automatic/manual transfer control switch is in the manual position.

A contactor shall be provided for the automatic transfer of control power. Each of the control power transformers shall be capable of furnishing power through the selective contactor for the bus tie breaker, feeder breakers, compartment heaters, interior lighting, utility outlets, battery chargers, and other miscellaneous equipment.

Secondary switchgear assembly or assemblies shall be supplied from two separate sources, with each source normally carrying load. Under normal operation, both main secondary breakers will be closed with the main-bus tie breaker open. Two sources of supply shall not be operated in parallel.

## 2.8 PAINTING

After fabrication, exposed ferrous-metal surfaces of secondary-unit substations and components equipment shall be prepared and painted.

Cold-rolled steel sheet and plate shall be cleaned of dirt, rust, grease, and oil.

Hot-rolled steel sheet and plate shall be sand-, shot-, or grit-blasted to white metal to obtain a completely clean surface.

Manufacturer's standard finish shall be used for most indoor installations. Dry-film thickness shall not be less than 5 mils if oil or resin base paint is used, or less than 1.5 mils if electrostatically applied and cured by baking. Color shall be metallic gray in accordance with FED-STD 595.

## 2.9 FACTORY TESTING

Factory tests on transformers and switchgear assemblies shall be made in accordance with the applicable provisions of the referenced standards.

Tests on transformers shall include resistance measurements of windings, ratio and polarity tests, and phase-rotation tests, no-load loss at rated voltage, excitation current at rated voltage, impedance voltage and load-loss at rated current, insulation power factor, impulse, temperature rise, short-circuit, oil power factor, and dielectric tests. Tests shall be conducted in accordance with IEEE C57.12.90 and IEEE C57.12.00, Table 16.

Tests on switchgear assemblies shall include mechanical operational tests, electrical operation and control-wiring tests, relaying and metering circuit performance tests, and dielectric tests. Tests shall be conducted in accordance with IEEE Std 4.

## PART 3 EXECUTION

## 3.1 INSTALLATION

Electrical installation shall conform to IEEE C2 and NFPA 70.

Complete assembly shall be electrically and mechanically connected together at the site from coordinated subassemblies shipped in complete sections from the manufacturer. Installation shall be carefully aligned, leveled, and secured to the concrete foundation in accordance with the manufacturer's written instructions.

Minimum size ground grid to switchgear ground connection shall be 4/0 AWG, copper ground wire, and shall also be connected to the switchgear ground bus.

All noncurrent-carrying parts and enclosures of the substation shall be bonded together and grounded to the substation ground pad with number 4/0 AWG, copper ground wire. Maximum resistance to ground of 20 ohms. All connections shall be exothermically welded in accordance with UL 467.

Installation Drawings shall be submitted for the Secondary Unit Substation. Drawings shall include complete details of equipment layout and design.

Listing of Product Installations for secondary unit substations shall include identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. List shall include purchaser, address of installation, service organization, and date of installation.

## 3.2 FIELD TESTING

Insulation resistance test voltage shall be 5000 volts for switchgear 4160 volts and above and 1000 volts for switchgear below 4160 volts. Test voltage shall be applied to the main bus for not less than 5 minutes and until 3 equal consecutive readings, 1 minute apart, are obtained. Readings shall be recorded every 30 seconds during the first 2 minutes and every minute thereafter. Minimum acceptable resistance shall be 100 megohms.

Upon satisfactory completion of the insulation-resistance test, the main bus shall be subjected to a high-voltage (hi-pot) withstand test. Test voltage shall be equal to 100 percent for 60 Hz of the values shown in IEEE C37.20.1 and IEEE C37.20.2 for metal-clad switchgear and metal-enclosed low-voltage power-circuit-breaker switchgear. Test shall be applied for 1 minute.

Final acceptance shall depend upon the satisfactory performance of the equipment under test. Substation shall not be energized until recorded test data have been approved by the Contracting Officer. Final Electrical Acceptance Tests reports shall be provided to the Contracting Officer. Reports shall have a cover letter/sheet clearly marked with the System name, Date, and the words "Final Test Reports - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

### 3.3 RELAY SETTINGS AND TESTS

#### 3.3.1 System Coordination

All circuit-interrupting devices shall be properly coordinated by the Contractor before the substation is energized. Protective relays shall be thoroughly inspected and adjusted at the site in the presence of and at the discretion of the Contracting Officer.

Trip ratings for all protective relays will be determined by the Contracting Officer and will be set by the manufacturer or the manufacturer's representative in the presence of the Contracting Officer at the construction site.

#### 3.3.2 Coordination Specialist

Services of a professional electrical engineer who specializes in relays and coordinating systems associated with electric-power apparatus for the manufacturer of the equipment shall coordinate all circuit-interrupting devices before the substation is energized. Duties and responsibilities of the specialist shall include the following work:

Preliminary survey and system coordination study:

Equipment shall be inspected and the intended function of each circuit-interrupting device and the manner in which it is connected shall be determined to provide a properly coordinated electrical power system under normal load and fault conditions.

Wiring diagrams furnished by the manufacturer shall be inspected and compared with actual connections of the equipment to verify that each device is properly connected to perform its intended function.

One-line diagrams shall be prepared that indicate by means of single lines and simplified symbols the course and component devices of an electric circuit or system of circuits and their electrical characteristics.

Necessary short-circuit calculations shall be reviewed to determine the minimum and maximum values of short-circuit current for faults anywhere in the system. Values of fault current to be expected at each protective device shown on the one-line diagrams shall be reviewed.

System or substation designer shall perform the following:

Time/current curves shall be plotted on a single sheet of graph paper for those devices that are to operate selectively in series with each other using a common current scale, with current ratings at the lowest-voltage level. Curves shall be plotted progressively as each circuit is studied, starting with the device furthest from the source. Each curve on the graph shall include tolerance band and shall show degree of coordination with each successive device. Adjustable and nonadjustable protective devices shall be coordinated to operate on the minimum current that will permit distinguishing between fault and load current in a minimum amount of time.

Time and current settings shall be selected for the adjustable devices that will operate in sequence with the nonadjustable devices to isolate a fault with a minimum of disturbance to the unfaulted portion of the system.

After completion of the preliminary survey and coordination study of the system, the following documents shall be prepared by the Contractor and approved by the Contracting Officer before proceeding with the work:

One-line diagram of electrical equipment and system

Short-circuit calculations and a table of short-circuit fault currents at critical points in the electrical system

Time/current coordination curves

Table of recommended relay settings

### 3.3.3 Preliminary Inspection, Relay Settings and Tests

Preliminary inspection of electrical equipment shall proceed; relay settings and tests shall be made only after the preliminary survey and system coordination survey have been completed. Preliminary inspection, relay settings, and tests shall be as follows:

Equipment shall be inspected for damage or maladjustment caused by shipment or installation. Wedges, ties, blocks, and other packing material installed by manufacturer to prevent damage in shipment shall be removed.

Protective relays, auxiliary relays, trip coils, trip circuit seal-in and target coils, fuses, and instrument transformers shall be verified to be of the proper type and range.

Electrical continuity tests shall be performed on current, potential, and control circuits.

Ratio and polarity tests shall be performed on current and potential transformers.

Insulation tests shall be performed on relays, wiring, instrument-transformer secondary windings, and instruments.

Each adjustable relay shall be removed from its case and calibrated separately as an instrument, using a variable alternating-current source and an accurate timing device. This procedure shall verify that the relay has not been damaged in shipment and that it will perform in accordance with previously prepared time-current coordination curves at specified current tap and time dial settings.

With the relay disconnected and the main current transformer effectively open, a test current shall be applied to the remainder of the secondary circuit to detect any open or short-circuit connections.

Relays shall then be reinstalled and connected into their current-transformer secondary and control circuits.

Any defects in electrical equipment, protective devices, wiring, or other conditions that will prevent complete coordination and the successful

operation of equipment shall be reported to the Contracting Officer before proceeding with the work.

After the installation has been thoroughly tested and certified to be in satisfactory condition, with relays calibrated and adjusted to the proper current tap and time dial setting, the Contractor shall request permission to energize the equipment at system voltage for final testing.

#### 3.4 ENERGIZING SECONDARY UNIT SUBSTATION

Secondary unit substation shall not be energized until it is completely installed and ready for operation. Site testing shall have been conducted and approved by the Contracting Officer.

Using ammeter, voltmeter, and wattmeter or phase-angle meter, the values and polarities of voltage and current shall be measured and compared with those expected in the various relay circuits. Contact positions of directional elements and the voltage relays shall be inspected and noted.

After inspection and satisfactory tests have been completed on all active relay circuits under a no load condition, each relay shall be given an operational test with diverted load currents or simulated ground faults.

A report shall be prepared with records of connections, electrical constants, settings, test values, operating performance, and failures or weaknesses found on test.

Tests and procedures for testing shall be in accordance with the manufacturer's recommendations, as approved by the Contracting Officer.

-- End of Section --